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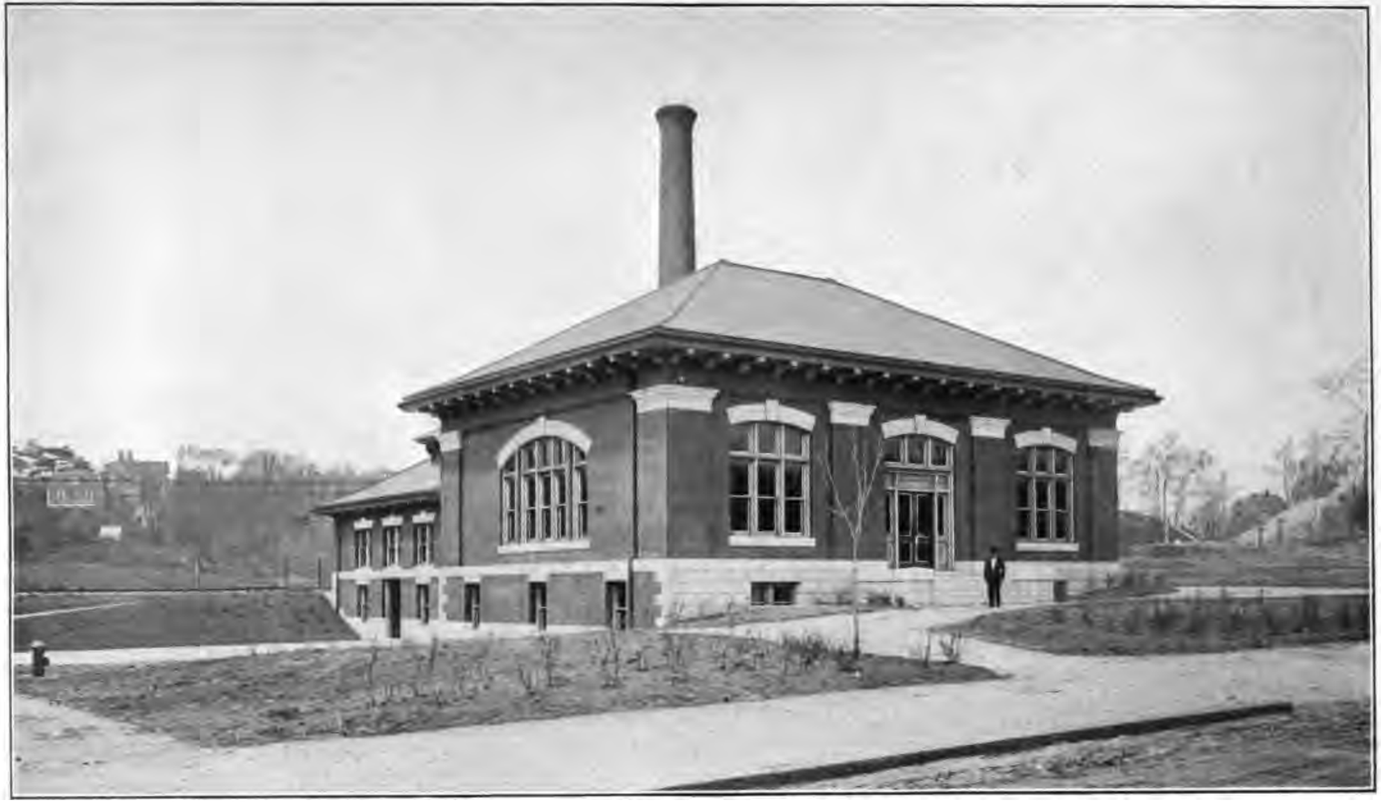

HYDE PARK PUMPING STATION.

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TWELFTH ANNUAL REPORT

OF THE

METROPOLITAN WATER AND SEWERAGE BOARD.

FOR THE YEAR 1912.

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CONTENTS.

PAGE
I. Organisation and Administration, ... 1
  (1) Board, Officers and Employés, ... 1
  (2) Offices and Buildings, ... 4
II. Metropolitan Water District, ... 4
III. Metropolitan Water Works — Construction, ... 5
  (1) Distribution System, ... 5
    (a) New Pumping Engine at Chestnut Hill, ... 5
    (b) Supply of Water to Hyde Park, ... 5
  (2) Acquisition of Lands and Settlements for Damages, ... 6
IV. Water Works — Maintenance, ... 7
  (1) Operation of Works, ... 7
  (2) Storage Reservoirs, ... 7
  (3) Aqueducts, ... 9
  (4) Distributing Reservoirs, ... 10
  (5) Pumping Stations, ... 11
  (6) Pipe Lines, ... 12
  (7) Clinton Sewerage Works, ... 13
  (8) Protection of the Water Supply, ... 14
    (a) Drainage Ditches, ... 15
    (b) Filter-beds, ... 15
    (c) Sanitary Inspection and Policing, ... 16
    (d) Laboratory Examinations, ... 16
  (9) Quality of the Water, ... 17
  (10) Forestry and Moth Suppression, ... 17
  (11) Electrolysis, ... 18
  (12) Wachusett Power Plant, ... 19
V. Water Works — Financial Statement, ... 19
  (1) Metropolitan Water Loans, Receipts and Payments, ... 20
  (2) Issues of Metropolitan Water Loan Bonds, ... 21
  (3) Metropolitan Water Loan Sinking Fund, ... 22
  (4) Annual Assessments and Receipts, ... 22
  (5) Supplying Water to Cities and Towns outside of District and to Water Companies, 23
  (6) Expenditures for the Different Works, ... 24
  (7) Detailed Financial Statement under Metropolitan Water Act, ... 28
    (a) Expenditures and Disbursements, ... 28
    (b) Receipts, ... 34
    (c) Assets, ... 36
    (d) Liabilities, ... 36
VI. Metropolitan Sewerage Works, ... 37
  (1) North Metropolitan Sewerage System — Construction, ... 38
    (a) New Mystic Sewer, ... 38
    (b) New Screening Works at East Boston Pumping Station, ... 39
    (c) Siphon under Metropolitan Sewer in East Boston, ... 39
  (2) South Metropolitan Sewerage System — Construction, ... 39
  (3) Acquisition of Land and Settlements, ... 40

PAGE

Report of Engineer of Sewerage Works — *Concluded.*
  Maintenance — *Concluded.*
    Pumping Stations — *Concluded.*
      Capacity and results — *Concluded.*
        South Metropolitan System, ... 148
          Ward Street Pumping Station, ... 148
          Quincy Pumping Station, ... 149
          Nut Island Screen-house, ... 151
          Quincy Sewage Lifting Station, ... 151
    Metropolitan Sewerage Outfalls, ... 153
    Material Intercepted at the Screens, ... 153

Appendix No. 1. — Contracts relating to the Metropolitan Water Works made and pending during the year 1912, ... 156
Appendix No. 2. — Tables relating to the Maintenance of the Metropolitan Water Works, . 161
  Table No. 1. — Monthly Rainfall in Inches at Various Places on the Metropolitan Water Works in 1912, ... 161
  Table No. 2. — Rainfall in Inches at Jefferson, Mass., in 1912, ... 162
  Table No. 3. — Rainfall in Inches at Framingham, Mass., in 1912, ... 163
  Table No. 4. — Rainfall in Inches at Chestnut Hill Reservoir in 1912, ... 164
  Table No. 5. — Rainfall in Inches on the Wachusett Watershed, 1897 to 1912, . . . 166
  Table No. 6. — Rainfall in Inches on the Sudbury Watershed, 1875 to 1912, ... 167
  Table No. 7. — Yield of the Wachusett Watershed in Gallons per Day per Square Mile from 1897 to 1912, ... 169
  Table No. 8. — Yield of the Sudbury Watershed in Gallons per Day per Square Mile from 1875 to 1912, ... 171
  Table No. 9. — Wachusett System. — Statistics of Flow of Water, Storage and Rainfall in 1912, ... 174
  Table No. 10. — Sudbury System. — Statistics of Flow of Water, Storage and Rainfall in 1912, ... 175
  Table No. 11. — Cochituate System. — Statistics of Flow of Water, Storage and Rainfall in 1912, ... 176
  Table No. 12. — Elevations of Water Surfaces of Reservoirs above Boston City Base at the Beginning of Each Month, ... 177
  Table No. 13. — Sources from which and Periods during which Water has been drawn for the Supply of the Metropolitan Water District, ... 178
  Table No. 14. — Average Daily Quantity of Water flowing through Aqueducts in 1912 by months, ... 180
  Table No. 15. — Statement of Operation of Engines Nos. 1 and 2 at Chestnut Hill Pumping Station No. 1 for the Year 1912, ... 181
  Table No, 16. — Statement of Operation of Engine No. 3 at Chestnut Hill Pumping Station No. 1 for the Year 1912, ... 182
  Table No. 17. — Statement of Operation of Engine No. 4 at Chestnut Hill Pumping Station No. 1 for the Year 1912, ... 183
  Table No. 18. — Statement of Operation of Engines Nos. 5, 6, and 7 at Chestnut Hill Pumping Station No. 2 for the Year 1912, ... 184
  Table No. 19. — Statement of Operation of Engine No. 12 at Chestnut Hill Pumping Station No. 2 for the Year 1912, ... 185
  Table No. 20. — Statement of Operation of Engine No. 8 at Spot Pond Pumping Station for the Year 1912, ... 186
  Table No. 21. — Statement of Operation of Engine No. 9 at Spot Pond Pumping Station for the Year 1912, ... 187
  Table No. 22. — Statement of Operation of Engine No. 10 at Arlington Pumping Station for the Year 1912, ... 188
  Table No. 23. — Statement of Operation of Engine No. 11 at Arlington Pumping Station for the Year 1912, ... 189
  Table No. 24. — (Meter Basis) Average Daily Consumption of Water in Cities and Towns supplied by the Metropolitan Water Works, ... 190

PAGE

Appendix No. 2 — *Concluded.*

Table No. 25. — (Meter Basis) Average Daily Consumption of Water from the Low-service System, ... 190
Table No. 26. — (Meter Basis) Average Daily Consumption of Water from the High-service and Extra High-service Systems, ... 191
Table No. 27. — Average Daily Consumption of Water in Cities and Towns supplied from Metropolitan Works, as measured by Venturi Meters in 1912, . . . 192
Table No. 28. — (Pump Basis) Consumption of Water in the Metropolitan Water District, as constituted in the Year 1912, and a Small Section of the Town of Saugus, from 1893 to 1912, ... 195
Table No. 29. — Chemical Examinations of Water from the Wachusett Reservoir, Clinton, 197
Table No. 30. — Chemical Examinations of Water from the Sudbury Reservoir, . . . 198
Table No. 31. — Chemical Examinations of Water from Spot Pond, Stoneham, . . . 199
Table No. 32. — Chemical Examinations of Water from Lake Cochituate, ... 200
Table No. 33. — Chemical Examinations of Water from a Tap at the State House, Boston, 201
Table No. 34. — Averages of Examinations of Water from Various Parts of the Metropolitan Water Works in 1912, ... 202
Table No. 35. — Chemical Examinations of Water from a Faucet in Boston, from 1892 to 1912, ... 203
Table No. 36. — Microscopic Organisms in Water from Various Parts of the Metropolitan Water Works, from 1898 to 1912, inclusive, ... 204
Table No. 37. — Number of Bacteria per Cubic Centimeter in Water from Various Parts of the Metropolitan Water Works, from 1898 to 1912, inclusive, . . . 206
Table No. 38. — Colors of Water from Various Parts of the Metropolitan Water Works in 1912, ... 206
Table No. 39. — Temperatures of Water from Various Parts of the Metropolitan Water Works in 1912, ... 207
Table No. 40. — Temperatures of the Air at Three Stations on the Metropolitan Water Works in 1912, ... 208
Table No. 41. — Table showing Length of Main Lines of Water Pipes and Connections owned and operated by Metropolitan Water and Sewerage Board, and Number of Valves set in Same, Dec. 31, 1912, ... 209
Table No. 42. — Statement of Cast-iron Hydrant, Blow-off and Drain Pipes, owned and operated by Metropolitan Water and Sewerage Board, Dec. 31, 1912, . 210
Table No. 43. — Length of Water Pipes, Four Inches in Diameter and Larger, in the Several Cities and Towns supplied by the Metropolitan Water Works, Dec. 31, 1912, ... 211
Table No. 44. — Number of Service Pipes, Meters and Fire Hydrants in the Several Cities and Towns supplied by the Metropolitan Water Works, ... 212
Table No. 45. — Average Maximum Monthly Heights, in Feet, above Boston City Base, to which Water rose at Different Stations on the Metropolitan Water Works in 1912, ... 213

Appendix No. 3. — Water Works Statistics for the Year 1912, ... 215
Appendix No. 4. — Contracts relating to the Metropolitan Sewerage Works, made and pending during the year 1912, ... 218
Appendix No. 5. — Tables relating to Metropolitan Sewerage Works, ... 223

Table No. 1. — North System. — Location, Length and Sizes of Sewers with Public and Special Connections, ... 223
Table No. 2. — South System. — Location, Length and Sizes of Sewers with Public and Special Connections, ... 225
Table No. 3. — North System. — Cities and Towns delivering Sewage; Approximate Miles of Sewer connected; Estimated Populations and Areas contributing and to contribute with Ratios of such Populations and Areas, . . . 226
Table No. 4. — South System. — Cities and Towns delivering Sewage; Approximate Miles of Sewer connected. Estimated Populations and Areas contributing and to contribute with Ratios of such Populations and Areas, . . . 227

Appendix No. 6. — Financial Statement presented to the General Court on Jan. 8, 1913, . 228
Appendix No. 7. — Legislation of the Year 1912 affecting the Metropolitan Water and Sewerage Board, ... 233

LIST OF ILLUSTRATIONS.

PAGE

Hyde Park Pumping Station, ... Frontispiece

Mystic River Tunnel Extension — Sinking Shaft at Charlestown End of Tunnel, ... 12

Mystic River Tunnel Extension — Heading in Rock in Tunnel under the River, ... 12

Wachusett Reservoir — White Pines near South Dike in Boylston, 7 Years Old — 1909, . . 17

Wachusett Reservoir — White Pines near South Dike in Boylston, 10 Years Old — 1912, . 18

Diagram showing Comparative Amounts of Water collected in the Different Years on the Sudbury and Wachusett Watersheds per Square Mile of Watershed, ... 58

Diagram showing Average Rate of Consumption of Water in the Metropolitan District in 1912 during the Entire Day and between the Hours of 1 and 4 at Night, ... 60

Diagram showing Average Rate of Consumption in Metropolitan Water District and Rainfall and Average Temperature of Air at Chestnut Hill Reservoir for Each Week during 1912, . 102

METROPOLITAN WATER AND SEWERAGE BOARD.

To the Honorable the Senate and House of Representatives of the Commonwealth of Massachusetts in General Court assembled.

The Metropolitan Water and Sewerage Board, established under the provisions of chapter 168 of the Acts of the year 1901, has already presented to your Honorable Body an abstract of the account of its doings, receipts, expenditures, disbursements, assets and liabilities for the fiscal year ending on November 30, 1912, and now, in accordance with the provisions of chapter 235 of the Acts of the year 1906, it presents a detailed statement of its doings for the calendar year ending on December 31, 1912, being its

TWELFTH ANNUAL REPORT

made since the consolidation of the Metropolitan Water Board and the Board of Metropolitan Sewerage Commissioners on March 20, 1901.

I. ORGANIZATION AND ADMINISTRATION.

(1) BOARD, OFFICERS AND EMPLOYÉS.

The term of office of Henry H. Sprague expired on March 21, 1912, and he was reappointed for the three years next succeeding. The membership of the Board has consequently remained as in the preceding year: Henry H. Sprague, chairman, Henry P. Walcott, M.D., and James A. Bailey, Junior. William N. Davenport has continued as secretary and in charge of the auditing department. Alfred F. Bridgman has been the purchasing agent and Miss Alice G. Mason the bookkeeper.

There are also employed in the administrative office a paymaster, an assistant in auditing, two general clerks, three stenographers and clerks, a telephone operator, a messenger, and a janitor with two assistants, one of whom acts as watchman.

Such general conveyancing work and investigation of real estate titles in the different counties as has been called for during the year has been performed by George D. Bigelow and Miss Celia M. Tibbetts.

The consulting engineers of the Board are Hiram F. Mills and Frederic P. Stearns, who are called upon for services when matters arise which require such consideration.

Dexter Brackett, Chief Engineer of the Water Works, has had supervision over the various departments of both construction and maintenance of the Water Works. William E. Foss has been Assistant to the Chief Engineer and has exercised a general charge over engineering work in all departments. The following have also acted under the direction of the Chief Engineer: Elliot R. B. Allardice, Superintendent of the Wachusett Department; Charles E. Haberstroh, Superintendent of the Sudbury and Cochituate Works and of the portion of the Weston Aqueduct above the Weston Reservoir; Samuel E. Killam, Superintendent in charge of the Weston Reservoir and the remaining portion of the Weston Aqueduct, and of all reservoirs and pipe lines within the Metropolitan District; and Arthur E. O'Neil, Superintendent of the several pumping stations.

There has been a still further decrease in the number of the engineering force during the past year. The average force employed on construction and maintenance during the year has included, in addition to the Chief Engineer, 4 department superintendents, 2 division engineers, 6 assistant engineers, and 33 others in various engineering capacities and as sanitary inspectors, clerks, stenographers and messengers, the total force numbering 46. The maximum engineering force employed at any one time during the year on both construction and maintenance was 49.

A maintenance force in addition to those engaged in engineering capacities, as above mentioned, numbering upon the average during the year 236, has been required at the pumping stations, upon reservoirs, aqueducts, pipe lines, and upon minor construction work. At the end of the year this force numbered 215.

William M. Brown resigned the position of Chief Engineer of Sewerage Works on February 21, 1912, to accept the position of

Chief Engineer of the Passaic Valley Sewerage Commissioners. The Board, in recognition of his services, caused the following entry to be made upon its records: —

> **In regretfully accepting the resignation of William M. Brown, the Chief Engineer of the Metropolitan Sewerage Works, the Board gratefully recognizes the great indebtedness which is due to him from the Commonwealth. From the beginning he took part in the construction of the Sewerage Works, and in the year 1895 was appointed the Chief Engineer of the Metropolitan Sewerage Commission; upon the consolidation of the Boards in 1901 he continued at the head of the Sewerage Division; and he has in these periods directed the construction of the larger part of the works which now constitute the North and South Metropolitan Sewerage systems. His service of more than sixteen years in charge of the building and operation of these systems has displayed a large constructive ability and an intimate knowledge of the details of maintenance. Faithful devotion and prompt execution and accomplishment have characterized the performance of all his duties.**

Frederick D. Smith was, on February 28, 1912, appointed as Engineer in charge of both construction and maintenance of the works. Mr. Smith has been assisted by Henry T. Stiff, Division Engineer in charge of the office and drafting, by 2 assistant engineers and by 10 others employed in different engineering capacities, and by 2 clerks and stenographers.

The maximum engineering force employed at any one time during the year on the construction and maintenance of the Sewerage Works was 16.

The regular maintenance force required in addition for the operation of the pumping stations, the care and inspection of the sewers, and for other parts of the Sewerage Works, exclusive of the engineers and day-labor forces, has upon the average numbered 170.

The whole regular force of the Sewerage Department at the end of the year numbered 186, of whom the Engineer and 15 assistants and draftsmen were engaged in general upon the works, and of the remainder, 103 were employed upon the North System and 67 upon the South System.

The day-labor forces under the supervision of the engineers and the immediate direction of the foremen have been employed during the year in connection with the extension of the East Boston pumping station and its equipment, and in the construction of a siphon at

Saratoga Street, East Boston, under the Metropolitan sewer, for the City of Boston.

The maximum number of men employed upon contracts and upon day-labor construction on the Sewerage Works during the year was for the week ending October 30, when the number amounted to 86.

(2) Offices and Buildings.

The offices of the Board and the secretary, and of the auditing and conveyancing departments, and the main engineering offices of both Water Works and Sewerage Works, are located in the buildings numbered 1 and 3 Ashburton Place, at the corner of Somerset Street, in Boston.

The headquarters of the Wachusett Department of the Water Works are at the gate and power house at the Wachusett Dam, in Clinton. The branch office for the Sudbury Department is maintained at South Framingham. Headquarters of the maintenance force of the Water Works for the northern part of the Metropolitan District are maintained in the Glenwood pipe yard in Medford, where there are offices, shops, store-rooms and stables; and the maintenance force for the southern part of the District has headquarters in like buildings at the Chestnut Hill Reservoir.

Branch headquarters of the maintenance and repair forces of the Sewerage Works are maintained for the North Metropolitan System at the stable and locker building at East Boston and at the Deer Island pumping station, and for the South Metropolitan System at the Ward Street pumping station and at the storage yard at Hough's Neck.

II. METROPOLITAN WATER DISTRICT.

The Metropolitan Water District now comprises the cities of Boston, Chelsea, Everett, Malden, Medford, Melrose, Newton, Quincy and Somerville, and the towns of Arlington, Belmont, Lexington, Milton, Nahant, Revere, Stoneham, Swampscott, Watertown and Winthrop, — in all 9 cities and 10 towns. The District has an area of 174.8 square miles, no additional municipalities having been admitted into the District during the year. Its population, according to the United States Census taken for April 1, 1910, was 1,070,256. The population of the District on July 1, 1912, the date upon which calculations for the Water Works are based, was estimated as 1,127,210.

The city of Newton, though belonging to the District, did not take water from Metropolitan sources during the year 1912.

III. METROPOLITAN WATER WORKS — CONSTRUCTION.

The total amount expended for the construction and acquisition of the Metropolitan Water Works since the passage of the Metropolitan Water Act in the year 1895 has been $42,036,311.97.

The total amount expended during the calendar year on account of the construction and acquisition of works has been $103,461.53. There has been expended on account of the Wachusett power plant the sum of $6,955.31; in the laying of the new 60-inch main for bringing the supply of water from the Weston Aqueduct into the Metropolitan District, the sum of $13,319.97; on account of the new pumping engine which has been installed at Chestnut Hill pumping station for the use of the southern high-service district, $14,093.20; in the laying of a new main to Hyde Park and on account of the construction of a new pumping station, the sum of $57,426.14; and for other minor works, engineering and administration expenses, the remaining sum of $11,666.91.

(1) Distribution System.

(a) *New Pumping Engine at Chestnut Hill.*

The new pumping engine for the southern high service had been put in operation in the preceding year, but the official duty trial was not made until October 16 and 17, 1912. The test which was made showed that the engine fulfilled the various requirements of the specifications and is capable of pumping 40,000,000 gallons of water per day with a lift of 130 feet. The engine has been accepted. The cost of the engine proper has been $99,769, but the additional sums paid for the engine foundations, providing new boilers and making the necessary connections and for incidental expenses, carry the entire cost of the work to $148,265.44, for which the estimate made was $150,000.

(b) *Supply of Water to Hyde Park.*

The district of Hyde Park, now a part of Boston, was in the preceding year connected with the Metropolitan main running through

Forest Hills, and the Board began the supply of water to the district on February 5, 1912.

The foundation of the new pumping station to be erected on Hyde Park Avenue was also begun in the preceding year, and the superstructure has been erected and, with the exception of some painting and plumbing, has been entirely completed. The walls of the building are red-faced brick with granite trimmings. The main engine room is 60 feet long and 43 feet wide, and the boiler room in the rear is 38 feet by 40 feet. A side track has been built and connected with the railroad, so arranged as to provide for the convenient delivering of coal and other supplies. Two pumping engines have been completed and at the end of the year their installation in the station was in progress, each engine having a capacity of pumping 3,000,000 gallons of water per day, with a lift of 140 feet. It is expected that the building will be entirely completed, the grounds graded, and the engines ready for operation in the early part of the year 1913.

The sum of $100,013.74 was expended for the laying of the pipe lines to connect the district of Hyde Park with the Metropolitan main, and for the pumping station, engines and equipment the expenditures have thus far amounted to $63,971.77. The total sum required for the work will be within the estimated cost of $212,000.

(2) Acquisition of Lands and Settlements for Damages.

The only additional land acquired during the past year was a purchase in Chelsea, for the pipe tunnel to East Boston, of 0.0324 of an acre in fee, and an easement in 0.0299 of an acre.

The Board conveyed back, in settlement, a parcel of 0.0514 of an acre in Newton which it had taken in connection with the construction of the tunnel for the Weston Aqueduct Supply Main, and granted an easement over 0.042 of an acre of land which it had before taken.

The settlements made during the year on account of land both purchased and taken have numbered 3. The total amount paid in settlements was $1,605. All of these settlements were effected by voluntary agreement.

There have been 4 takings of land in fee, including a total of 179.874 acres, to all but one parcel of which title by deed had previously been acquired.

The following is a list of the takings made during the year for the Water Works: —

Takings for Metropolitan Water Works for the Year 1912.

No.	Location and Description.	Former Owner.	Recorded.	Purpose of Taking.
143	Newton, — Land adjoining southeasterly side of Cochituate Aqueduct location. Area, fee in 0.133 of an acre.	Charles G. Rice.	1912. Feb. 21.	Weston Aqueduct Supply Mains.
144	West Boylston, — Ten parcels of land on Prescott Street, Sterling Street, Pleasant Street, along Boston & Maine Railroad and Waushacum Brook. Area, fee in 126.97 acres.	Frank H. Baldwin and Lena Leasott.	Mar. 15.	Improvement of Wachusett watershed.
145	Natick, — Four parcels of land adjacent to lands in which the right, title and interest of the City of Boston therein were taken by the Commonwealth on January 1, 1898. Area, fee in 0.638 of an acre.	Augustus J. Wilder, Sylvester H. Frost, Maggie M. Porter, Edward E. and Diana B. Wilgus, Trustees of William A. Prescott, and Elisabeth F. Hand.	Mar. 14.	Improvement of Cochituate watershed.
146	Sterling, West Boylston, Clinton and Boylston, — Nine parcels of land, three of which are in Sterling, two partly in Sterling and partly in West Boylston, one in West Boylston, one in Clinton and two in Boylston. Area, fee in 51.896 acres.	Herbert C. Fisher, Tennis Dugas, Louisa Dugas, Burton W. Potter, Clarence R. Streeter, Carrie L. Bates, Clephane L. and Ellen A. Lord.	Apr. 1.	Improvement of Wachusett watershed.

IV. WATER WORKS — MAINTENANCE.

(1) Operation of Works.

The maintenance and operation of the Metropolitan Water Works during the past calendar year has required the expenditure of $450,551.83. This amount, however, includes the sum of $50,795.42 expended on the Mystic tunnel extension on the account of the City of Boston, for which the city has already reimbursed the Commonwealth to the extent of $46,213.28.

(2) Storage Reservoirs.

The reservoirs which are maintained for the collection and storage of water in the various watersheds, and from which is drawn through the different aqueducts the water for distribution to the various municipalities in the District, are capable of holding in storage a total of 80,908,900,000 gallons. At the beginning of the year the quantity in storage was about two-thirds of the entire capacity. The smallest amount in storage at any time during the year was on February 20, when the reservoirs contained 59,064,200,000 gallons, but there was a constant gain until about the middle of May, when all the reservoirs were filled. They remained full until the end of the first week in June; after that date there was a constant loss, more or less rapid, until the end of the year, when the amount in storage was 64,220,100,000 gallons. The year closed, therefore, with a net gain during the year of 4,240,100,000 gallons. The capacities of the various reservoirs are as follows: —

		Capacity in Gallons.
Cochituate watershed: —		
Lake Cochituate, including Dudley Pond, Natick, Framingham and Wayland,		2,328,300,000
Sudbury watershed: —		
Sudbury Reservoir, Southborough and Marlborough,	7,253,500,000	
Framingham Reservoir No. 1, Framingham,		
Framingham Reservoir No. 2, Ashland and Framingham,	529,900,000	
Framingham Reservoir No. 3, Framingham,	1,180,000,000	
Ashland Reservoir, Ashland,	1,416,400,000	
Hopkinton Reservoir, Hopkinton and Ashland,	1,520,900,000	
Whitehall Reservoir, Hopkinton,	1,256,900,000	
Farm Pond, Framingham,	167,500,000	
		13,612,600,000
Wachusett watershed: —		
Wachusett Reservoir, Clinton, Boylston, West Boylston and Sterling,		64,968,000,000
Total,		80,908,900,000

The water in the Wachusett Reservoir reached high-water mark on May 15, and for the period following May 17 until June 22 some water was allowed to flow through the waste channel into the river below the dam. At the end of the year the water surface was 11.21 feet below high-water mark, or 1.49 feet higher than at the beginning of the year.

Since the reservoir was filled the action of the waves has caused a constant wearing away of the shores, especially in places where there were steep banks composed of fine material. By this caving in of the shores the area of the reservoir has been increased to the extent of about 14.5 acres, requiring in each year considerable additional stripping of the soil back of the immediate shore, various reinforcements and the repair of paving and riprap.

The action of heat and cold and of the frost upon the granolithic surface of the top of the Wachusett Dam and upon the joints of the parapet wall, and in the masonry on the up-stream face of the dam, has been such as to require considerable attention and repair.

The Sudbury Reservoir, which receives the water from the Wachusett Aqueduct and from which the water is discharged into the Weston Aqueduct and into Framingham Reservoir No. 3, and Framingham Reservoir No. 3, from which water is discharged into the Sudbury Aqueduct, have been both kept nearly full during the year.

Framingham Reservoir No. 2 was kept full, and during the early part of the year water was drawn from it for the Metropolitan supply.

It has not been found necessary during the past year to draw for the supply of the Metropolitan District from the waters of Framingham Reservoir No. 1, Farm Pond, Ashland and Hopkinton reservoirs and Whitehall Pond, but water has been discharged from both Framingham Reservoir No. 1 and Framingham Reservoir No. 2 into Farm Pond, from which the town of Framingham has taken the most of its supply during the year.

Water was drawn from Lake Cochituate during portions of February, June, August, September, October and November, in the aggregate a little more than one and a half billion gallons, equivalent to a daily average supply of 4,211,000 gallons.

(3) Aqueducts.

The Wachusett Aqueduct was in service for the passage of the water from the Wachusett Reservoir to the Sudbury Reservoir during portions of 292 days in the year, and the quantity of water flowing through the aqueduct was equal to an average of 92,127,000 gallons per day for the entire year. The drawing of the water from the reservoir into the aqueduct was to a considerable extent governed by the requirements of the power station.

For distribution to the cities and towns of the Metropolitan District water was drawn through the Sudbury Aqueduct during portions of 353 days, the use of the aqueduct having been interrupted for periods of a few days each on account of the repairs upon the aqueduct where passing over Echo Bridge. The daily average for the whole year flowing through the Sudbury Aqueduct was 74,221,000 gallons, the average of 72,115,000 gallons being drawn from

Framingham Reservoir No. 3 and of 2,100,000 gallons from Framingham Reservoir No. 2.

Owing to cracks in the aqueduct which had developed at the crossing at Echo Bridge, and were causing a considerable leakage, it was deemed necessary to line with lead the bottom and sides of the aqueduct at this point. The work was rendered more difficult on account of the impossibility of stopping the flow through the aqueduct except for short periods. The lining was accomplished for a distance of 508 feet at a cost of $5,537.70.

The Cochituate Aqueduct was in operation during 100 days of the year and the quantity conveyed was equal to 4,211,000 gallons per day for the entire year.

The Weston Aqueduct was in use throughout the year except for portions of two days when its use was discontinued for the purpose of making some repairs at Siphon chambers Nos. 1 and 2. The daily average flow through the aqueduct was 36,632,000 gallons.

(4) DISTRIBUTING RESERVOIRS.

Beside the various storage reservoirs there are located within the Metropolitan Water District various distributing reservoirs and standpipes which not only furnish a considerable amount of water in storage, but serve also as a protection and relief in case of accident and emergency, and are serviceable in securing a proper distribution of the water in the District.

These distributing reservoirs and standpipes are as follows: —

	Capacity in Gallons.
Spot Pond, Stoneham and Medford,	1,791,700,000
Chestnut Hill Reservoir, Brighton district of Boston,	300,000,000
Weston Reservoir, Weston,	200,000,000
Fells Reservoir, Stoneham,	41,400,000
Mystic Reservoir, Medford,	26,200,000
Waban Hill Reservoir, Newton,	13,500,000
Forbes Hill Reservoir, Quincy,	5,100,000
Bear Hill Reservoir, Stoneham,	2,450,000
Arlington Standpipe, Arlington,	550,000
Forbes Hill Standpipe, Quincy,	330,000
Total,	2,381,230,000

It has been felt desirable that the grounds about the distri reservoirs, being situated within the populated portions of the trict and attractive from their natural positions, should be well cared for. Several of these are places of much resort in the summer. The Board has not been disposed to restrain the public from the benefit of the grounds, and considerable care and policing has been required in order to protect them and the water supply from injury and enforce a proper enjoyment of them.

(5) PUMPING STATIONS.

During the past year 69 per cent. of all the water furnished for distribution to the Metropolitan District was pumped at the two Chestnut Hill stations, and the remainder of the water, 31 per cent. of the whole, was distributed by gravity. This proportion was considerably greater than that of last year, when only 27 per cent. was delivered by gravity. Other pumping has been required for supplying the higher portions of the District at the Spot Pond, Arlington and West Roxbury stations.

The average quantity pumped per day at the Chestnut Hill stations was 80,002,000 gallons, at the Spot Pond station 8,030,000 gallons, at the Arlington station 876,000 gallons, and at the West Roxbury station 833,000 gallons, a total of 89,741,000 gallons per day.

The following are the several pumping stations: —

	Number of Engines.	Contract Capacity per Day (Gallons).	Lift (Feet).
Chestnut Hill High-service Station,	4	66,000,000	138
Chestnut Hill Low-service Station,	3	105,000,000	60
Chestnut Hill Low-service Station,	1	40,000,000	130
Spot Pond Station,	2	30,000,000	125
Arlington Station,	2	3,000,000	290
West Roxbury Station,	3	3,750,000	140

The cost of operating all the stations, counting the coal actually consumed, was $105,038.22, or $3.198 per million gallons pumped. The increase of $0.224 above the cost in the preceding year is owing to the larger cost of fuel and to the considerable repairs required.

The total amount of coal purchased during the year was 8,650.76 gross tons, of which 7,983.02 tons were bituminous, 411.74 tons anthracite, 38.84 tons buckwheat anthracite and 217.16 tons anthracite screenings. The average cost of bituminous coal delivered in the bins at the various stations varied from $3.91 to $4.67; the average cost of anthracite coal was $5.38; the cost of buckwheat was $2.86; and the average cost of anthracite screenings varied from $2.50 to $3.08.

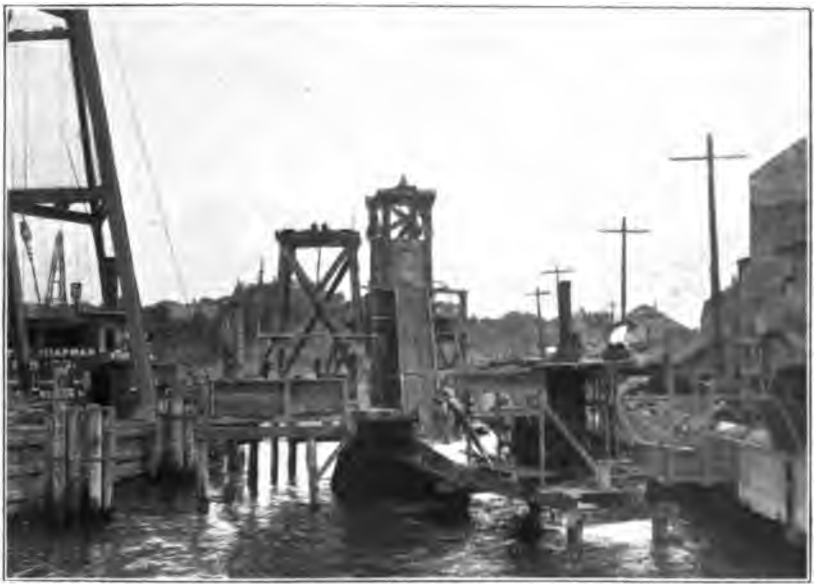
The various requirements regarding the number of thermal units. the percentage of volatile matter and the percentage of ash and moisture under which the coal was purchased by contract proved satisfactory, and the coal which was furnished by the various contractors was of good quality.

(6) Pipe Lines.

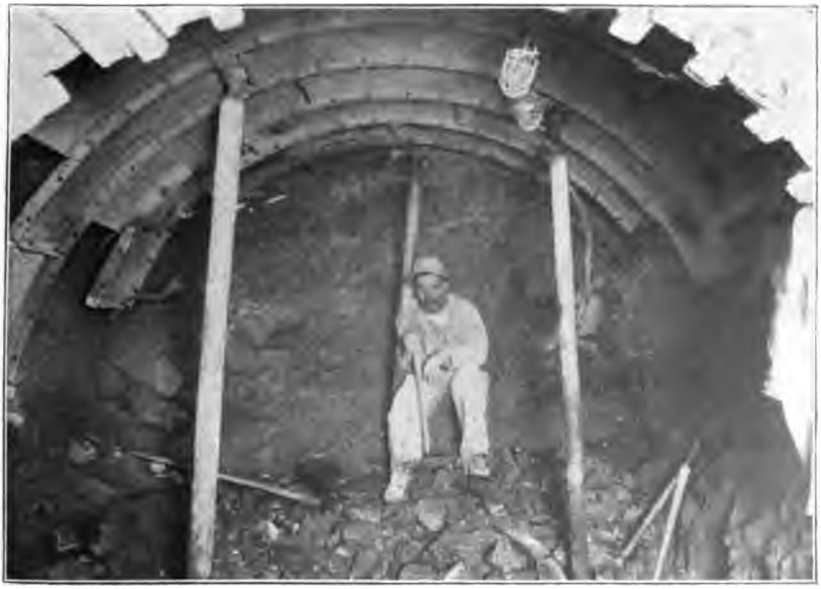
The Board has owned and operated during the past year pipe lines of a total length of 101.73 miles, a length of only 0.15 of a mile having been added during the year. The local mains of 4 inches and more in diameter with which the Metropolitan mains are connected for the distribution of water to the various municipalities of the District have a total length of 1,745.9 miles.

The only serious break during the year occurred on February 13 on Adams Street in Milton, in the 24-inch main supplying Milton and Quincy. One pipe was split for nearly its entire length, apparently by reason of its having settled upon the brick masonry of a sewer which had been constructed subsequent to the laying of the pipe. Owing to the depth to which the ground was frozen the work of repair was rendered difficult, and special efforts had to be made in order to continue the supply to the districts dependent upon it while the repairs were in progress. There were 39 leaks of a minor character, the larger portion of which occurred at defective joints, both the wooden and leaded joints.

The widening of the north channel in the Mystic River between Charlestown and Chelsea by the City of Boston made necessary the extension of the tunnel which carries the 24-inch Metropolitan water main under the bed of the river. As the work required processes of much difficulty involving the excavation of rock and quicksand, and the use of compressed air, it was deemed wiser that it should be done by day labor under the direction of the Board. Accordingly arrange-



MYSTIC RIVER TUNNEL EXTENSION — Sinking Shaft at Charlestown End of Tunnel.



MYSTIC RIVER TUNNEL EXTENSION — Heading in Rock in Tunnel under the River.

ment was made with the City by which the entire work should be carried out by the Board and the City should pay the expense.

The new tunnel is built in general of brick carried for a distance of 273 feet, with an interior diameter of 6 feet, and its centre line is about 43½ feet below mean low water. The tunnel was finished and the new pipe line was put into operation in December. The entire cost of the work as charged to December 31, 1912, was $55,059.15, $50,795.42 of which is to be paid by the city of Boston, and $4,263.73 is properly chargeable to the Board.

The Legislature of 1911 directed the County Commissioners of Essex County to reconstruct the Fox Hill Bridge over the Saugus River between the city of Lynn and the town of Saugus. As the Metropolitan 16-inch water main supplying Swampscott and Nahant is laid in the river channel at and in connection with the old bridge, the construction of the new bridge requires a change in the water main. The work of building the new bridge was undertaken in the past season and a water pipe has been laid for the time being on the temporary bridge. So far the bridge construction has proceeded very slowly, and it will be impossible to place the water pipe in its permanent location until the completion of the bridge in the coming season. The expense of the changes was imposed by statute upon the Metropolitan Water District.

(7) CLINTON SEWERAGE WORKS.

Wires for transmitting electric energy have been carried from the power station at the Wachusett Dam to the Clinton Sewerage Station and an electric pump and motor installed at the station, so that for the last two months electric energy has been substituted for steam for pumping the sewage upon the filter-beds. The cost of the new equipment has been $7,625.29. It is expected not only that the work of pumping will be more satisfactorily performed, but that there will be a considerable saving in expense.

The amount of sewage received was more than 25 per cent. in excess of the quantity contributed by the town in the preceding year. This large increase seems to be due to the leaky condition of the town sewers.

The average quantity of sewage pumped per day was 1,057,000 gallons. The total cost of operating the station was $3,988.44, or

$10.31 per million gallons pumped, the increase of cost over that of last year being chiefly on account of labor and fuel.

There has been a constant improvement in the effluent from the filter-beds since the year 1909, when extensive improvements were made, and the results of the past year have been the best attained since the beginning of the operation of the works.

The total cost of maintenance of the filter-beds has been $4,176.60, an increase over that of last year, but the cost per million gallons treated has decreased from $12.63 to $10.80.

(8) PROTECTION OF THE WATER SUPPLY.

No additional general improvements have been completed during the past year for the protection of the water in the different watersheds from pollution, but investigations have been made and arrangements effected with the purpose of undertaking such improvements in the coming year.

There has been a recent growth in the manufacturing industries in both the Cochituate and Wachusett watersheds. The starting up of old mills and the building of new ones has largely increased the disposal of manufacturing wastes, and the growth of the industries has caused the erection of many new buildings for dwelling and other purposes as well as the re-occupancy of old premises.

A considerable district in the southern part of the town of Framingham has been developed by the erection of buildings for manufacturing and dwelling purposes, including especially a very low area tributary to Beaver Dam Brook. Much of this area is so low that it is difficult to dispose of the sewage satisfactorily by cesspools or other means usually adopted. It is necessary so far as possible to extend the town's system of sewers into this region.

The Board included in its estimates for the year 1912, upon the basis of which the appropriation of that year was made by the Legislature, the sum of $20,000 for the protection and improvement of the water supply, with the expectation that this amount would be largely devoted to remedying troubles which existed upon the portion of the Cochituate watershed which was included in the town of Framingham. The Board under this appropriation entered into an engagement with the town of Framingham by which the Commonwealth should contribute to the building of sewers in progress and projected, the town itself having appropriated larger sums for the purpose. The operations contemplated have not yet been carried out but it is expected that they will be prosecuted or completed in the coming year.

A better disposal and purification of sewage and manufacturing wastes from dwellings and factories in portions of the Wachusett watershed seem also to be called for in the early future, and investigations have been instituted with reference to the making of definite recommendations. The Board has accordingly included in its estimates for the current year the further special sum of $20,000 for the protection and improvement of the water supply, with the expectation that if the appropriation is made the larger portion of this sum may be devoted to the better care of the manufacturing wastes and of the sewage of the town of Holden entering the Quinepoxet River near its outlet into the Wachusett Reservoir.

(*a*) *Drainage Ditches.*

The various drainage ditches which have been constructed to an aggregate length of 36.36 miles have required at least annual cleaning and various repairs and in some places renewals. Paved ditching has been introduced in places into brooks which were feeders of the water supply.

(*b*) *Filter-beds.*

The Marlborough Brook filter-beds which receive the storm water from the more thickly settled portions of the city of Marlborough have been in general adequate for the filtration of the waters received, there having been overflows of comparatively small quantities on only three days in the year.

The filter-beds which receive for filtration the water flowing through the village of Sterling, before entering the reservoir, as well as the smaller filter-beds which receive the drainage from Sterling Junction, the Worcester County Training School at West Boylston, and from the swimming pool at Southborough, have all been in successful operation and required only the usual attention.

The Pegan Brook pumping station, from which is pumped upon the filter-beds the drainage from thickly settled portions of the town of Natick before its entrance into Lake Cochituate, was in operation 199 days in the year and with the exception of a few hours in two different days there was no overflow from the storage basin.

(*c*) *Sanitary Inspection and Policing.*

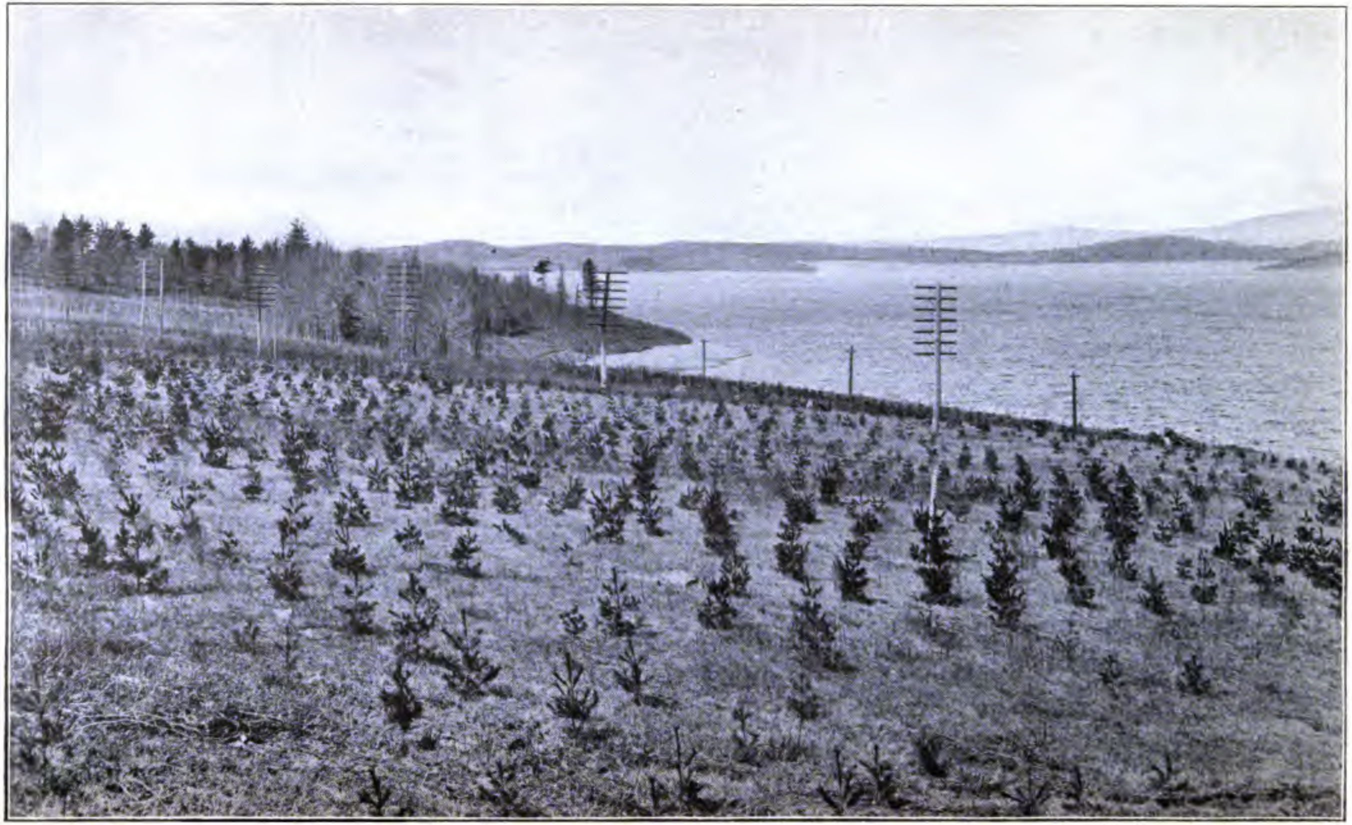
Constant inspection of the watersheds is required and maintained not only by the Sanitary Inspector and his assistants but also by members of the maintenance forces.

Surveillance is kept over all premises which are subject to conditions which may render them injurious or menacing to the water supply. During the past year examination has been made of 1,546 premises on the Wachusett watershed and of 7,459 premises on the Sudbury and Cochituate watersheds, and reports have been made thereon with reference to cesspools, privy, sink and barn drainage, manufacturing wastes and sewer connections. In the larger part of the cases found "unsatisfactory", remedy, at least temporary, has been effected, and though the number of premises calling for examination has considerably increased, there has been a decided reduction in the number of unsatisfactory cases.

It has been necessary to employ special watchmen and police, especially on Sundays and holidays and in the camping and bathing season, in addition to the sanitary forces, to enforce the laws and regulations of the Board for the protection of the water supply. There have been several prosecutions on account of bathing, and there have been a few violations of the regulations of the Board on account of hunting on the Commonwealth's lands and of fishing in places prohibited by the rules.

(*d*) *Laboratory Examinations.*

Water is drawn for consumption in the District from time to time from the different sources of supply according to the results obtained from the examinations made in the laboratories of the State Board of Health and of this Board. Chemical examinations of the various waters used were made in 408 cases by the State Board, and there were in addition 2,441 microscopical and 1,335 bacterial examinations made in the laboratory of this Board. By means of these examinations not only the better waters are furnished to the District but immediate measures may be taken to remedy any troubles which are found to exist.



WACHUSETT RESERVOIR—WHITE PINES NEAR SOUTH DIKE IN BOYLSTON 7 YEARS OLD—1909.

(9) QUALITY OF THE WATER.

The quality of the water which has been supplied to the Metropolitan District during the past year has been at least equal to that furnished in recent years. The conditions attending the yield of the water were such that the Board was enabled to draw about four-fifths of the entire supply from the Wachusett Reservoir, leaving only about one-fifth to be taken from the Sudbury and Cochituate sources. On account of the large proportion thus supplied from the Wachusett Reservoir the color of the water was considerably improved. There were the usual number of microscopical organisms present in the water affecting at times its taste or odor, but these did not occur in sufficient numbers to make the water objectionable or occasion any special complaint.

(10) FORESTRY AND MOTH SUPPRESSION.

The only nursery now maintained by the Board in connection with the Wachusett department is that at Oakdale, which contains white pine seedlings from one to three years old to a number exceeding 220,000. The nursery established in Southborough for the Sudbury department contains upward of 70,000 three-year old white pine seedlings.

Little additional planting was done during the year, the older nurseries having ceased on account of exhaustion to yield proper seedlings and the new seedlings obtained from the State Forester not having reached a sufficient age for planting.

There was less than the usual damage by forest fires upon the watersheds. The only two considerable fires were near the Wachusett Reservoir, one burning over about 9.5 acres in Boylston and destroying 4,300 young white pines, and another extending over 27.7 acres in West Boylston and Sterling and destroying 10,000 white pines.

The ravages of the gypsy and brown-tail moths and of the elm-leaf beetle have somewhat abated during the past year within the Metropolitan District, but the lands of the Board about the Cochituate and Sudbury reservoirs in Framingham and Southborough and around the Wachusett Reservoir have suffered more severely. Painting the egg clusters of the gypsy moth with creosote and burning the nests of the brown-tail moths, and extensive spraying of the trees on account of moths and elm-leaf beetles have been resorted to.

The shoots of the white pine trees infested with the pine-tree weevil have been cut off and burned. The injury effected by the weevil seems to have been less than that caused in preceding years.

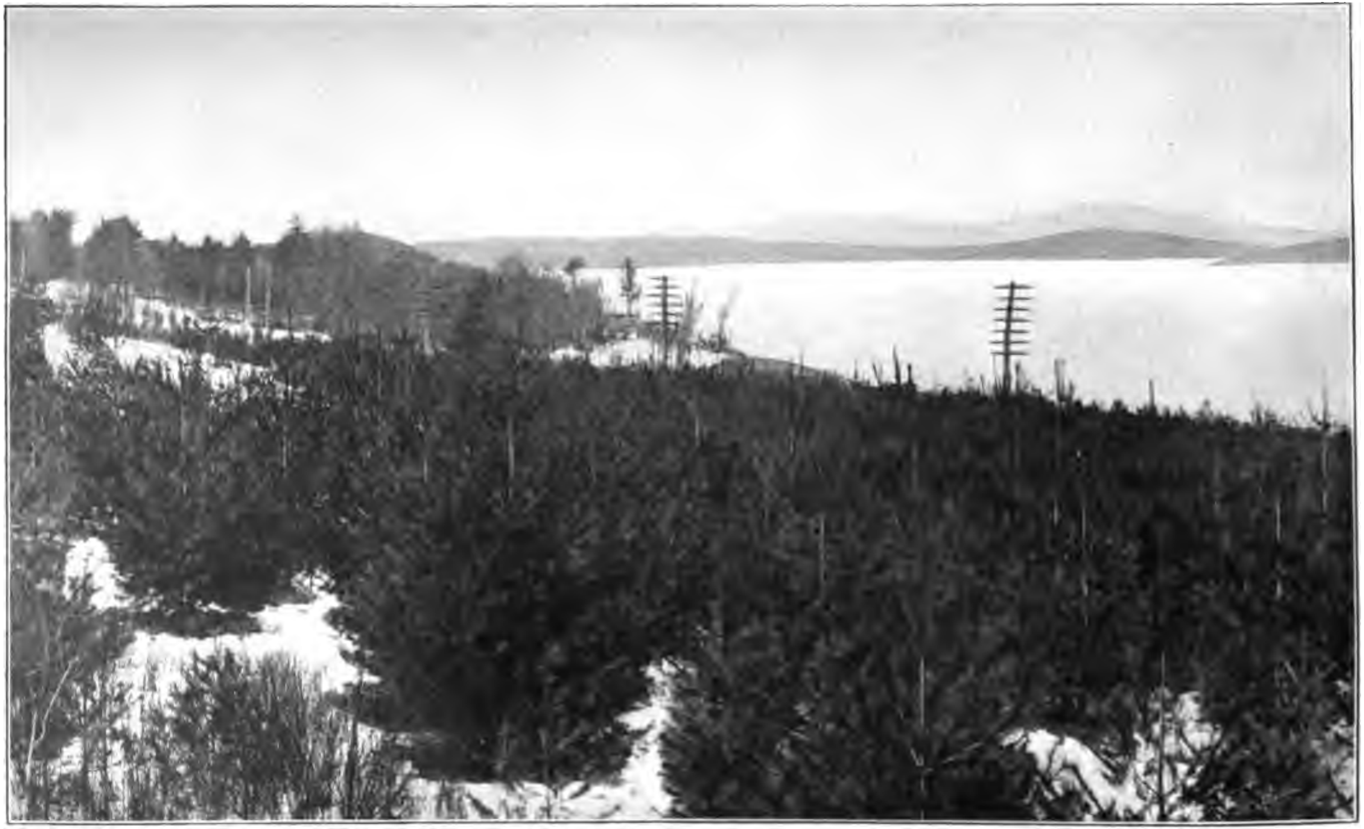
A careful inspection has been made of the chestnut trees upon the lands of the Commonwealth on account of the spread of the chestnut bark disease. The investigations made indicate that the disease has extended more or less over the larger part of the growth of chestnut trees upon the lands of the Board. There are certain areas in Boylston, West Boylston and Sterling which have been especially affected, and the ravages have been so great as to destroy a considerable portion of the trees and to threaten the life of those which remain. The Board has begun to cut down the trees in the regions most infested, as there seems to be no means of staying the progress of the disease, and so far no remedy has been discovered to prevent the extending of the scourge which threatens the destruction of the entire chestnut growth. If the ravages continue it seems that it will be necessary to do extensive cutting wherever the chestnut trees are found. The cutting of the wood involves very considerable expenditures, but the larger part if not all will be returned in the sale of lumber and wood.

The work so far accomplished has been performed by the regular forces of the departments and has proceeded with a view of determining what more extended action shall be expedient in the future.

(11) ELECTROLYSIS.

The investigations which have been made during the past year indicate that in general there has been little change in the conditions relative to electrolytic action upon the pipe systems. A largely increased current of electricity has, however, been found flowing on the Metropolitan mains between Malden and Chelsea, and in Cambridge and Medford between the Fitchburg Railroad and Spot Pond.

The 24-inch pipe which was laid in the old tunnel under the Mystic River between Charlestown and Chelsea was found to be so badly affected by electrolysis that new pipes had to be substituted. The 24-inch line in Broadway in Chelsea, near the power station of the Bay State Street Railway Company, has so suffered from the electrolytic action that it seems necessary to relay a portion of the line in this locality during the coming season.



WACHUSETT RESERVOIR—WHITE PINES NEAR SOUTH DIKE IN BOYLSTON, 10 YEARS OLD—1912.

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(12) WACHUSETT POWER PLANT.

The hydro-electric power station at the Wachusett Dam has generated and furnished power to the Connecticut River Transmission Company under the contract during the entire year. The machinery was in active operation on 261 days, and for a considerable portion of the time power has been furnished in excess of the minimum amount which the contract required should be taken by the Company. The operation of the plant has been entirely successful, and it has furnished electric energy to the Transmission Company equivalent in amount to an average of 2,937 horse power per 10-hour day on the 261 days that the plant was in operation.

Since the middle of October a small quantity of the electric energy generated has been transmitted to the Clinton sewerage pumping station for the purpose of supplying power for the lifting of the sewage at this station.

The cost of operating the power station has been $8,995.66, and the Commonwealth has received from the Connecticut River Transmission Company for the energy supplied a total of $30,297.95.

V. WATER WORKS — FINANCIAL STATEMENT.

The financial abstract of the receipts, disbursements, assets and liabilities of the Board for the State fiscal year, beginning with December 1, 1911, and ending with November 30, 1912, was, in accordance with the requirements of chapter 235 of the Acts of the year 1906, presented to the General Court in January last, and a copy of this financial abstract is printed as Appendix No. 6.

The more detailed statement of its doings required by said chapter for the calendar year 1912, in relation to the Metropolitan Water Works, is herewith presented.

The Metropolitan Water Loans authorized for the construction and acquisition of works have amounted to $42,690,000. To this sum are added the proceeds from the sale of property by the Board, and these amounted on January 1, 1913, to $310,836.14. The total amount, therefore, which the Board has been authorized to expend is $43,000,836.14. The amount of expenditures approved by the Board for payment out of the Metropolitan Water Loan Fund was, for the year 1912, $103,461.53, and the total amount so approved for payment since the beginning of the work up to January 1, 1913, has been $42,036,311.97. There was accordingly a balance remaining at the beginning of the year 1913 amounting to $964,524.17.

The Treasurer of the Commonwealth has issued from time to time, on the request of the Board, bonds to the amount of $41,788,000. Of this $41,398,000 were sinking fund bonds and were issued for terms of thirty-nine and one-half and forty years from date of issue, and bear interest at the rate of 3 and 3½ per cent. per annum. The remainder of the bonds, amounting to $390,000, were issued on the serial payment plan, bonds being payable each year for a period of thirty-nine years and bearing interest at the rate of 3½ per cent. per annum.

The sinking fund established for the payment of the sinking fund bonds at maturity amounted on January 1, 1913, to $9,829,356.80.

The net increase in the debt during the calendar year, as represented by the Metropolitan Water Loans outstanding, was $45,000, bonds issued on the serial payment plan to the amount of $5,000 having been paid. The increase of the sinking fund for the payment of the debt at maturity was, during the same period, $875,919.36. There has been, therefore, a decrease in the net debt during the calendar year amounting to $830,919.36.

The amount approved by the Board for the maintenance and operation of the Water Works for the year 1912 was $450,551.83. This amount includes the sum of $50,795.42 expended for the Mystic Tunnel Extension, for which the city of Boston reimburses the Commonwealth, and on account of which the sum of $46,213.28 was paid by the city to the Treasurer of the Commonwealth during the past year to the credit of the Maintenance Fund.

The assessments for the year 1912 for the payment of interest on the bonds, for the sinking fund requirements and for the expenses of operation and maintenance of the Water Works, which were levied upon the various cities and towns in the Metropolitan District, amounted to $2,289,490.68.

(1) METROPOLITAN WATER LOANS, RECEIPTS AND PAYMENTS.

The loans authorized for the construction and acquisition of the Metropolitan Water Works, the receipts which are added to the proceeds of these loans, the expenditures for the construction and acquisition of works, and the balance available on January 1, 1913, have been as follows: —

Loans authorized under acts prior to 1911,	$41,878,000 00	
Loan under chapter 464 of the Acts of 1911, for the extension of the Southern High Service,	212,000 00	
Loan under chapter 694 of the Acts of 1912, for purchase of Fisher Hill Reservoir and other property of the City of Boston,	600,000 00	
		$42,690,000 00
Receipts from the sales of property applicable to the construction and acquisition of works: —		
For the year ending December 31, 1912,	$11,979 43	
For the period prior to January 1, 1912,	208,856 71	
	$220,836 14	
Receipt from town of Swampscott for admission to the Metropolitan Water District paid into Loan Fund (St. 1909, c. 320),	90,000 00	
		310,836 14
		$43,000,836 14
Amount approved by the Metropolitan Water and Sewerage Board for payments out of the Water Loan Fund: —		
For the year ending December 31, 1912,	$103,461 53	
For the period prior to January 1, 1912,	41,932,850 44	
		42,036,311 97
Balance January 1, 1913,		$964,524 17

(2) Issues of Metropolitan Water Loan Bonds.

The Treasurer of the Commonwealth, under authority given him to issue from time to time, on request of the Board, negotiable bonds to an amount not exceeding $42,690,000 to be designated the "Metropolitan Water Loan", has sold bonds to the amount of $41,788,000. The bonds sold prior to 1911, amounting to $41,398,000, were sinking fund bonds. A list of these bonds sold is given in the 9th and 10th Annual Reports. The bonds sold in the years 1911 and 1912 were serial bonds, amounting to $390,000, and bearing interest at 3½ per cent. per annum, as follows: —

DATE OF SALE.	Amount of Bonds sold.	Price received.	Premiums.	Date Due.
Jan. 30, 1911, ...	$200,000	$100 036	$72 00	$5,000 each year, Jan. 1, 1912, to Jan. 1, 1951, inclusive.
Jan. 29, 1912, ...	190,000	100 349	663 10	$5,000 each year, Jan. 1, 1913, to Jan. 1, 1946, inclusive. $4,000 each year, Jan. 1, 1946, to Jan. 1, 1951, inclusive.

The bonds amounting to $140,000, stated in the 11th Annual Report as sold on Aug. 4 and 17, 1911, were temporary loans. The sale on Jan. 29, 1912, of bonds to the amount of $190,000 included provision for the payment of the temporary loans of $140,000.

Prior to May 1, 1906, all premiums received from the sales of bonds were applied to the payment of the current charges in reduction of the annual assessments, but since that date, under the provisions of chapter 337, Acts of 1906, they have been paid into the sinking fund.

(3) METROPOLITAN WATER LOAN SINKING FUND.

The sinking fund established by the Treasurer of the Commonwealth has amounted at the end of each year to sums as follows: —

December 31, 1895, .	$226,286 05
December 31, 1896, .	699,860 70
December 31, 1897, .	954,469 00
December 31, 1898, .	1,416,374 29
December 31, 1899, .	1,349,332 97
December 31, 1900, .	1,573,619 72
December 31, 1901, .	1,662,426 95
December 31, 1902, .	2,256,803 81
December 31, 1903, .	2,877,835 59
December 31, 1904, .	$3,519,602 92
December 31, 1905, .	4,207,045 69
December 31, 1906, .	4,897,822 62
December 31, 1907, .	5,643,575 69
December 31, 1908, .	6,419,283 28
December 31, 1909, .	7,226,262 31
December 31, 1910, .	8,089,902 91
December 31, 1911, .	8,953,437 44
December 31, 1912, .	9,829,356 80

(4) ANNUAL ASSESSMENTS AND RECEIPTS.

Assessments for the year 1912 amounting to $2,289,490.68 were required for the payment of the interest on the bonds issued by the Commonwealth, the sinking fund requirements and the expenses of operation and maintenance of the Water Works. The requirements were, for interest, $1,429,570.72; for the sinking fund, $512,884; for serial bonds, $9,336.90, and for maintenance and operation, $337,699.06. These assessments were made by the Treasurer of the Commonwealth upon the various municipalities as follows: —

Arlington,	$18,996 13	Newton,	$6,274 75
Belmont,	8,591 38	Quincy,	54,558 24
Boston,	1,792,123 83	Revere,	27,919 68
Chelsea,	48,658 68	Somerville,	109,232 14
Everett,	47,338 81	Stoneham,	10,019 69
Lexington,	8,173 66	Swampscott,	10,814 10
Malden,	43,833 54	Watertown,	18,600 53
Medford,	27,130 03	Winthrop,	14,150 34
Melrose,	20,978 01		
Milton,	16,312 53		$2,289,490 68
Nahant,	5,784 61		

The comparatively small sum assessed upon the city of Newton was owing to the fact that this municipality has not reached the safe capacity of its own sources of water supply and has not as yet been furnished with water.

The proceeds from the operations of the Board, exclusive of the proceeds from sales of property and of water, are required by statute to be applied to the payment of the interest, the sinking fund requirements and expenses of maintenance and operation of works. These for the year 1912 amounted to $88,035.37.

(5) SUPPLYING WATER TO CITIES AND TOWNS OUTSIDE OF DISTRICT AND TO WATER COMPANIES.

Sums have been received during the year 1912 under the provisions of the Metropolitan Water Act, for water furnished, as follows: —

Town of Framingham,	$1,418 30
Town of Revere (on account of water furnished to a portion of the town of Saugus for 1911),	250 00
United States Government (for Peddock's Island),	2,572 91
Town of Wakefield,	3,060 51
Westborough State Hospital,	1,848 45
	$9,150 17

The sums so received prior to March 23, 1907, were annually distributed among the cities and towns of the District, but since that date, in accordance with the provisions of chapter 238 of the Acts of 1907, the sums so received have been paid into the sinking fund.

(6) EXPENDITURES FOR THE DIFFERENT WORKS.

The following is a summary of the expenditures made in the various operations for the different works: —

CONSTRUCTION AND ACQUISITION OF WORKS.	For the Year ending December 31, 1912.		From Beginning of Work to December 31, 1912.	
Administration applicable to all parts of the construction and acquisition of the works,		$4,188 43		$298,515 30
Wachusett Dam and Reservoir: —				
Wachusett Dam,	-		$2,378,206 05	
Power plant,	$6,954 91		113,786 61	
Power house floor,	40		8,169 18	
North Dike,	-		792,264 68	
South Dike,	-		137,075 55	
Removal of soil,	-		2,536,612 66	
Relocation of railroads,	-		881,872 45	
Roads and bridges,	-		547,867 76	
Real estate,	126 50		3,240,398 41	
Damages, real estate not taken, business and loss of wages,	-		532,247 07	
Other expenses,	-		8,547 92	
		7,081 81		11,177,048 34
Improving Wachusett watershed,		79 60		235,714 32
Wachusett Aqueduct,		-		1,797,948 85
Sudbury Reservoir,		6 00		2,923,152 96
Protection of Sudbury supply,		-		129,190 36
Improving Sudbury watershed,		-		95,711 84
Protection of Cochituate supply,		-		9,000 00
Improving Cochituate watershed,		-		8,860 68
Improving Lake Cochituate,		-		104,141 29
Pipe lines, Dam No 3 to Dam No. 1,		-		48,471 48
Pipe line, Rosemary siphon,		-		23,142 98
Weston Aqueduct: —				
Aqueduct,	-		$2,353,820 11	
Reservoir,	-		289,001 82	
Real estate, taxes and other expenses,	-		206,668 18	
		-		2,849,490 11
Distribution system: —				
Low service: —				
New 48-inch main, Section 31,	-		$162,698 06	
Section 38, Tunnel (East Boston main),	$2 40		48,708 06	
Pipe lines and connections,	6 08		1,795,169 83	
Pumping station, Chestnut Hill,	-		462,572 19	
Reservoir, Spot Pond,	-		582,188 73	
Gate-house and connections, Chestnut Hill Reservoir,	-		65,480 88	
Real estate and other expenses,	1,253 00		94,191 97	
Amounts carried forward,	$1,261 48	$11,355 84	$3,211,009 72	$19,700,388 51

Construction and Acquisition of Works.	For the Year ending December 31, 1912.		From Beginning of Work to December 31, 1912.	
Amounts brought forward,	$1,261 48	$11,355 84	$3,211,009 72	$19,700,388 51
Distribution system — *Con.*				
Northern high service: —				
Pipe lines and connections,	5 00		528,444 86	
Spot Pond pumping station,	-		291,829 35	
Fells Reservoir, Stoneham,	-		141,392 94	
Bear Hill Reservoir, Stoneham,	-		38,267 70	
Real estate and other expenses,	-		14,838 05	
Southern high service: —				
Pipe lines and connections,	5 88		526,725 37	
Section 39 (Hyde Park connection),	3,766 76		52,526 39	
Pumping station, Chestnut Hill,	14,093 20		382,662 61	
Forbes Hill Reservoir, Quincy,	-		90,008 49	
Waban Hill Reservoir, Newton,	-		61,592 11	
Real estate and other expenses,	-		10,226 36	
Northern extra high service,	-		101,898 59	
Southern extra high service: —				
Pipe lines and connections,	5 35		22,887 16	
Hyde Park connection,				
Section 40,	745 64		30,699 12	
Section 41,	2,067 69		16,788 23	
Hyde Park Pumping Station,	49,580 45		56,938 99	
Real estate and other expenses,	10 25		7,103 20	
Weston Aqueduct supply mains,	13,319 97		1,043,335 47	
Meters and connections,	538 54		90,199 41	
Improving Spot Pond Brook,	-		3,991 23	
Glenwood pipe yard,	-		33,100 59	
Chestnut Hill pipe yard,	-		11,311 26	
		85,400 21		6,767,772 20
Stock — pipes, valves, castings, etc., purchased and sent first to storage yards, and later transferred, as needed, to the various parts of the work: —				
Amount received,	$6,812 50		$2,544,928 69	
Transferred from storage yards to the various sections of the work and included in costs of special works,	107 02		2,400,678 72	
		6,705 48		144,249 97
Diversion of water, South Branch of Nashua River,[1]		-		1,363,935 31
Acquisition of existing water works: —				
Reimbursement city of Boston, partially constructed Reservoir,	-		$1,157,921 59	
Boston water works, taken January 1, 1898,	-		12,768,948 80	
Amounts carried forward,		$103,461 53	$13,926,870 39	$27,976,345 99

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[1] Of the total expenditures from the beginning of the work, the sum of $150,939.89 is for Clinton sewerage system.

CONSTRUCTION AND ACQUISITION OF WORKS.		For the Year ending December 31, 1912.	From Beginning of Work to December 31, 1912.	
Amounts brought forward, ...		. . . $103,461 53	$13,926,870 39	$27,976,345 99
Acquisition of existing water works — *Con.*				
Spot Pond taken from Malden, Medford and Melrose, ...		-	1,240,229 62	
Waban Hill Reservoir purchased from Newton,		-	60,000 00	
Expenses: —				
Engineering, ...	$22,617 52			
Conveyancing, ...	3,862 92			
Legal, expert and court, . . .	46,648 03			
			73,128 47	
			$15,300,228 48	
Deduct following, transferred and charged to special works: —				
Reimbursement city of Boston, transferred to Sudbury Reservoir, ...	$1,157,921 59			
Waban Hill Reservoir transferred to Distribution Department, .	60,000 00			
Stock — pipes, engines, etc., included with Boston Water Works and transferred to Distribution Department, . .	22,340 91			
			1,240,262 50	
				14,059,965 98
Total for construction and acquisition of works,		$103,461 53		$42,036,311 97

MAINTENANCE AND OPERATION.	For the Year ending December 31, 1912.	
Administration, ...		$15,050 89
General supervision, ...		32,955 20
Taxes and other expenses, ...		38,733 79
Wachusett Reservoir Department: —		
Superintendence, ...	$10,936 78	
Reservoir, ...	8,447 59	
Forestry, ...	9,000 68	
Protection of supply, ...	2,445 31	
Buildings and grounds, ...	3,307 72	
Wachusett Dam, ...	4,402 26	
Wachusett Aqueduct, ...	4,726 51	
Clinton sewerage system: —		
Pumping station, ...	3,954 13	
Electric plant, ...	6,653 52	
Sewers, screens and filter-beds, ...	4,361 85	
Amounts carried forward, ...	$58,236 35	$86,739 88

MAINTENANCE AND OPERATION.	For the Year ending December 31, 1912.	
Amounts brought forward,	$58,236 35	$86,739 88
Wachusett Reservoir Department — *Con.*		
Sanitary inspection,	918 59	
Swamp drainage,	3,182 58	
Power plant,	5,902 30	
		68,239 82
Sudbury Department: —		
Superintendence, Framingham office,	$10,154 13	
Ashland Reservoir,	1,461 15	
Hopkinton Reservoir,	1,372 46	
Whitehall Reservoir,	420 01	
Framingham Reservoirs Nos. 1, 2 and 3,	5,903 23	
Sudbury Reservoir,	6,644 21	
Lake Cochituate,	4,860 05	
Marlborough Brook filters,	2,870 76	
Pegan filters,	3,446 51	
Sudbury and Cochituate watersheds,	921 25	
Sanitary inspection,	3,105 18	
Cochituate Aqueduct,	4,489 31	
Sudbury Aqueduct,	13,074 12	
Weston Aqueduct,	5,716 80	
Improving Lake Cochituate,	324 86	
		64,764 03
Distribution Department: —		
Superintendence,	$4,026 97	
Arlington pumping station, pumping service,	8,246 69	
Chestnut Hill low-service pumping station, pumping service,	41,635 90	
Chestnut Hill high-service pumping station, pumping service,	30,819 87	
Spot Pond pumping station, pumping service,	15,607 68	
West Roxbury pumping station, pumping service,	6,936 28	
Hyde Park pumping station, pumping service,	5 00	
Arlington standpipe,	497 73	
Bear Hill Reservoir,	108 04	
Chestnut Hill Reservoir and grounds,	9,769 31	
Fells Reservoir,	716 95	
Forbes Hill Reservoir,	1,604 29	
Mystic Lake, conduit and pumping station,	1,179 98	
Mystic Reservoir,	925 09	
Waban Hill Reservoir,	169 25	
Weston Reservoir,	2,664 37	
Spot Pond,	6,706 21	
Buildings at Spot Pond,	340 00	
Pipe lines: —		
Low service,	64,608 39	
Northern high service,	6,908 43	
Northern extra high service,	204 79	
Southern high service,	6,534 81	
Southern extra high service,	324 78	
Supply pipe lines,	1,338 51	
Amounts carried forward,	$211,879 32	$219,743 73

MAINTENANCE AND OPERATION.	For the Year ending December 31, 1912.	
Amounts brought forward,	$211,879 32	$219,743 73
Distribution Department — *Con.*		
Buildings at Chestnut Hill Reservoir,	1,390 11	
Chestnut Hill pipe yard,	1,511 84	
Glenwood pipe yard and buildings,	3,632 90	
Stables,	9,012 97	
Waste prevention,	3 00	
Venturi meters,	1,168 32	
Measurement of water,	1,924 65	
Arlington pumping station, buildings and grounds,	284 99	
		230,808 10
Total for maintaining and operating works,	. . .	$450,551 83

(7) DETAILED FINANCIAL STATEMENT UNDER METROPOLITAN WATER ACT.

The Board herewith presents, in accordance with the requirements of the Metropolitan Water Act, a detailed statement of the expenditures and disbursements, receipts, assets and liabilities for the year 1912.

(*a*) *Expenditures and Disbursements.*

The total amount of the expenditures and disbursements on account of construction and acquisition of works for the year beginning January 1, 1912, and ending December 31, 1912, is $103,461.53, and the total amount from the time of the organization of the Metropolitan Water Board, July 19, 1895, to December 31, 1912, is $42,036,311.97.

For maintenance and operation the expenditures for the year, including $50,795.42 expended for the Mystic Tunnel Extension, for which the City of Boston reimburses the Commonwealth, have been $450,551.83.

The salaries of the commissioners, and the other expenses of administration, have been apportioned to the construction of the works and to the maintenance and operation of the same, and appear under each of those headings.

The following is a division of the expenditures according to their general character: —

General Character of Expenditures.	For the Year ending December 31, 1912.		From Beginning of Work to December 31, 1912.	
Construction of Works and Acquisition by Purchase or Taking.				
Administration.				
Commissioners,	$1,916 66		$125,060 24	
Secretary and auditor,	375 00		51,717 03	
Clerks and stenographers,	1,115 00		65,457 21	
Legal services,	-		2,359 00	
Traveling,	-		3,712 87	
Stationery and printing,	340 69		14,040 91	
Postage, express and telegrams,	51 00		3,108 17	
Furniture and fixtures,	-		4,289 59	
Alterations and repairs of buildings,	19 30		5,810 86	
Telephone, lighting, heating, water and care of building,	199 23		12,400 50	
Rent and taxes, main office,	169 20		5,936 89	
Miscellaneous expenses,	2 35		4,622 03	
		$4,188 43		$298,515 30
Engineering.				
Chief engineer and department engineers,	$841 90		$208,390 18	
Principal assistant engineers,	990 31		164,475 95	
Engineering assistants,	5,092 15		1,063,677 74	
Consulting engineers,	-		26,135 07	
Inspectors,	1,488 50		310,234 70	
Architects,	-		36,161 19	
Railroad and street car travel,	-		27,751 20	
Wagon hire,	-		45,337 53	
Stationery and printing,	72 28		27,093 40	
Postage, express and telegrams,	15 00		7,746 00	
Engineering and drafting instruments and tools,	-		19,533 88	
Engineering and drafting supplies,	63 69		25,168 62	
Books, maps and photographic supplies,	14 02		7,181 34	
Furniture and fixtures,	-		14,980 11	
Alterations and repairs of buildings: —				
Main office,	57 91		14,169 00	
Sub-offices,	-		2,939 36	
Telephone, lighting, heating, water and care of buildings: —				
Main office,	597 76		27,868 11	
Sub-offices,	23 65		19,694 47	
Rent and taxes, main office,	507 60		17,579 15	
Rent of sub-offices and other buildings,	-		4,526 74	
Field offices and sheds,	-		1,274 49	
Clinton office building,	-		9,866 87	
Unclassified supplies,	-		8,264 87	
Miscellaneous expenses,	99 05		9,489 30	
		9,863 82		2,099,539 27
Amounts carried forward,		$14,052 25		$2,398,054 57

General Character of Expenditures.	For the Year ending December 31, 1912.		From Beginning of Work to December 31, 1912.	
Amounts brought forward,	. . .	$14,052 25		$2,398,054 57
Construction.				
Preliminary work (borings, test pits and other investigations): —				
Advertising,	$56 80		$6,806 77	
Other preliminary work as given in detail in preceding annual report,	-		155,530 89	
		56 80		162,337 66
Contracts, Wachusett Reservoir: —				
Contracts completed and final payments made prior to January 1, 1912,	-		$5,427,800 13	
McBride & Co., Stillwater improvement,	-		23,314 67	
Sundry bills paid under this contract,	-		3,552 11	
For Power Plant: —				
S. Morgan Smith Co., hydro-electric plant,	$6,850 00		68,389 62	
		6,850 00		5,523,056 53
Contracts completed, improving Wachusett Watershed,		-		11,893 75
Contracts completed, Wachusett Aqueduct,		-		1,447,208 55
Contracts completed, Sudbury Reservoir,		-		1,545,028 33
Contracts completed, protection Sudbury supply,		-		9,000 00
Contracts completed, improving Lake Cochituate,		-		60,657 45
Contracts completed, protection Cochituate supply,		-		9,000 00
Contracts completed, Rosemary siphon,		-		5,916 96
Contracts completed, pipe line, Dam No. 3 to Dam No. 1,		-		17,240 22
Contracts completed, Clinton sewerage system,		-		66,878 22
Contracts completed, Weston Aqueduct,		-		2,376,004 54
Contracts, Distribution System: —				
Contracts completed and final payments made prior to January 1, 1912,	-		$5,091,828 58	
Cavanagh Bros., laying water pipes on Sect. 6, Weston Aqueduct supply mains,	$200 00		40,777 77	
Andrew M. Cusack, laying water pipes on Sect. 41, southern extra high service,	1,023 28		4,778 68	
Pratt & Cady Co., water valves,	1,396 85		5,000 00	
Robb Eng. Co., Ltd., boilers for Hyde Park pumping station,	1,711 00		1,711 00	
Michael Russo & Son, for laying water pipes on Sect. 39, southern high service,	2,715 55		16,298 85	
Warren Foundry and Machine Co., cast-iron pipes and special castings,	4,763 28		4,763 28	
Camoia & Williams, laying water pipes on Sect. 33, northern high service,	-		14,721 27	
De Vincenzi & Baruffoldi, laying water pipes on Sect. 36, northern extra high service,	-		3,233 31	
Joseph Hanreddy, laying water pipes on Sect. 7, Weston Aqueduct Supply Mains,	12,406 19		114,462 13	
Amounts carried forward,	$24,216 15	$20,959 05	$5,297,574 87	$13,632,276 78

GENERAL CHARACTER OF EXPENDITURES.	For the Year ending December 31, 1912.		From Beginning of Work to December 31, 1912.	
Amounts brought forward,	$24,216 15	$20,959 05	$5,297,574 87	$13,632,276 78
Construction — Con.				
Contracts, Distribution System — *Con.*				
Holly Manufacturing Co., pumping engine for Chestnut Hill high-service pumping station,	13,000 00		98,000 00	
Laidlaw-Dunn-Gordon Co., for furnishing two pumping engines for Hyde Park pumping station,	5,176 50		5,176 50	
A. Varnerin Co., for building the superstructure of Hyde Park pumping station,	17,331 63		17,331 63	
		59,724 28	$5,418,083 00	
Deduct value of pipes, valves, etc., included in above list, transferred to maintenance account December 31, 1900,	-		3,139 77	
				5,414,943 23
Additional work: —				
Labor,	$10,141 95		$838,954 70	
Professional services, medical services, analyses, etc.,	4 00		4,512 74	
Traveling,	42		2,815 85	
Rent,	20 00		4,342 22	
Water rates,	-		1,454 77	
Freight and express,	31 82		14,531 99	
Jobbing and repairing,	10 25		10,460 22	
Tools, machinery, appliances and hardware supplies,	628 18		90,729 62	
Electrical supplies,	32 48		7,356 34	
Castings, ironwork and metals,	1,876 15		93,217 84	
Iron pipe and valves,	1,243 49		81,558 27	
Blasting supplies,	-		1,950 15	
Paint and coating,	-		5,471 98	
Fuel, oil and waste,	-		12,661 35	
Lumber and field buildings,	418 31		92,091 46	
Drain pipe,	37 07		9,594 23	
Brick, cement and stone,	1,674 41		36,966 81	
Sand, gravel and filling,	582 35		9,089 18	
Municipal and corporation work,	3,901 71		224,712 05	
Police service,	-		210,801 74	
Sanitary inspection,	-		13,107 09	
Judgments and settlements for damages,	-		53,124 26	
Unclassified supplies,	76 01		19,099 42	
Miscellaneous expenses,	165 78		7,718 34	
		20,844 38		1,846,322 62
Legal and expert: —				
Legal services,	-		$4,668 82	
Expert services,	-		1,862 66	
Court expenses,	-		1,317 20	
Miscellaneous expenses,	-		185 80	
				8,034 48
Amounts carried forward,		$101,527 71		$20,901,577 11

General Character of Expenditures.	For the Year ending December 31, 1912.		From Beginning of Work to December 31, 1912.	
Amounts brought forward,		$101,527 71		$20,901,577 11
Real Estate.				
Legal and expert: —				
Legal services,	-		$4,736 31	
Conveyancer and assistants,	$109 00		110,970 97	
Experts,	80 00		18,088 93	
Appraisers,	100 00		22,507 75	
Court expenses,	-		11,139 43	
Counsel expenses,	-		43 25	
Conveyancing supplies,	4 50		3,198 03	
Conveyancing expenses,	35 32		6,052 61	
Miscellaneous expenses,	-		4,334 15	
Settlements made by Board,	1,605 00		3,441,264 10	
Judgments,	-		170,716 24	
Taxes and tax equivalents,	-		68,182 41	
Care and disposal,	-		86,901 14	
		1,933 82		3,948,135 32
Damages to Real Estate not taken, to Business and on Account of Loss of Wages.				
Legal and expert: —				
Legal services,	-		$1,130 67	
Expert services,	-		2,857 62	
Court expenses,	-		15,394 34	
Miscellaneous expenses,	-		125 00	
Settlements,	-		415,513 65	
Judgments,	-		116,733 42	
		-		551,754 70
Claims on Account of Diversion of Water.				
Legal and expert: —				
Legal services,	-		$3,774 98	
Expert services,	-		19,339 69	
Court expenses,	-		20,775 49	
Miscellaneous expenses,	-		1,289 58	
Settlements,	-		917,350 00	
Judgments,	-		220,969 67	
		-		1,183,499 41
Purchase of Existing Water Works.				
Legal and expert: —				
Legal services,	-		$1,878 89	
Expert services,	-		13,569 82	
Court expenses,	-		29,728 38	
Miscellaneous expenses,	-		1,470 94	
Settlements and judgments,	-		15,227,100 01	
		-		15,273,748 04
Relocation Central Massachusetts Railroad.				
Settlements,		-		177,597 39
Total amount of construction expenditures,		$103,461 53		$42,036,311 97

General Character of Expenditures.	For the Year ending December 31, 1912.	
Maintenance and Operation of Works.		
Administration: —		
Commissioners,	$5,833 34	
Secretary and assistants,	6,099 34	
Rent,	578 09	
Repairs of building,	75 01	
Fuel,	68 02	
Lighting,	55 93	
Care of building,	422 89	
Postage,	206 00	
Printing, stationery and office supplies,	1,498 87	
Telephones,	81 82	
Traveling expenses,	90 78	
Miscellaneous expenses,	73 14	
		$15,083 23
General supervision: —		
Chief engineer and assistants,	$26,394 63	
Rent,	1,734 81	
Repairs of building,	428 66	
Fuel,	204 08	
Lighting,	167 79	
Care of building,	1,268 82	
Postage,	49 00	
Printing, stationery and office supplies,	587 94	
Telephones,	336 05	
Traveling expenses,	707 07	
Miscellaneous expenses,	1,076 85	
		32,955 20
Pumping service: —		
Labor,	$61,204 07	
Fuel,	35,092 26	
Oil, waste and packing,	1,320 74	
Repairs,	3,322 17	
Small supplies,	1,537 91	
Rent,	774 27	
		103,251 42
Reservoirs, aqueducts, pipe lines, buildings and grounds: —		
Superintendents,	$9,310 00	
Engineering assistants,	10,584 49	
Sanitary inspectors,	3,269 79	
Labor, pay roll,	168,360 40	
Labor, miscellaneous,	4,151 30	
Alterations and repairs of pumping stations,	853 26	
Alterations and repairs of other buildings and structures,	2,385 87	
Automobiles,	7,823 82	
Brick,	1,529 62	
Amounts carried forward,	$208,268 55	$151,289 85

GENERAL CHARACTER OF EXPENDITURES.	For the Year ending December 31, 1912.	
Amounts brought forward,	$208,268 55	$151,289 85
MAINTENANCE AND OPERATION OF WORKS — *Con.*		
Reservoirs, aqueducts, pipe lines, buildings and grounds — *Con.*		
Brooms, brushes and janitor's supplies,	205 83	
Castings, ironwork and metals,	5,982 76	
Cement and lime,	1,658 39	
Drafting and photo supplies,	196 90	
Fertilizer and planting material,	1,089 88	
Freight and express,	732 46	
Fuel,	6,182 72	
Gypsy moth supplies,	922 22	
Hardware,	1,075 52	
Hay and grain,	2,241 50	
Lighting,	738 54	
Lumber,	2,224 46	
Machinery,	6,024 32	
Paints and oils,	1,390 99	
Pipe and fittings,	3,488 96	
Postage,	167 58	
Printing, stationery and office supplies,	667 63	
Rubber and oiled goods,	538 88	
Stable expenses,	921 28	
Sand, gravel and stone,	710 13	
Traveling expenses,	2,881 52	
Telephones,	1,055 29	
Teaming,	1,385 01	
Tools and appliances,	5,362 09	
Vehicles, harnesses and fittings,	398 09	
Miscellaneous expenses,	2,503 04	
Contracts: —		
The Snare & Triest Co., contract 29-M, for dredging, etc., in connection with lowering 20-inch siphon at Fox Hill Bridge under the Saugus River between the city of Lynn and the town of Saugus (chapter 631, Acts of 1912),	1,460 99	
Robb Engineering Co., Ltd., for installing 99 spellerized tubes in vertical boiler at Pegan Brook Pumping Station, Natick, Mass.,	85 00	
		260,560 53
Payments in lieu of taxes,		38,701 45
Total expenditures for maintenance and operation,		$450,551 83

(*b*) *Receipts.*

The total amount of receipts from the operations of the Board and from sales of property for the year beginning January 1, 1912, and ending December 31, 1912, is $109,164.97, and the total amount from the time of the organization of the Metropolitan Water Board, July 19, 1895, to December 31, 1912, is $874,649.81. The general character of these receipts is as follows: —

General Character of Receipts.	For the Year ending December 31, 1912.		From Beginning of Work to December 31, 1912.	
For distribution back to District: —				
Fees for admission to District,	-		$92,265 00	
Water furnished to cities and towns outside of District,	-		90,454 77	
Water furnished to water companies,	-		37,145 88	
		-		$219,865 65
To the credit of the loan fund: —				
Real estate and buildings,	$22 00		$44,096 34	
Tools, supplies and reimbursements,	11,957 43		176,739 80	
District entrance fees (Swampscott),	-		90,000 00	
		$11,979 43		310,836 14
To the credit of the maintenance fund: —				
Tools, supplies and reimbursements,	$78,502 56		125,281 50	
		78,502 56[1]		125,281 50
To the credit of the sinking fund: —				
Water furnished to cities and towns outside of District and to water companies,	$9,150 17		$41,769 21	
Forfeiture for contracts awarded but not executed,	-		500 00	
Rents,	1,985 00		97,682 10	
Land products,	7,329 11		74,931 00	
Unclassified receipts and interest,	218 70		3,784 21	
		18,682 98		218,666 52
Total receipts,	. . .	$109,164.97		$874,649 81

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[1] Included in this amount is the sum of $46,213.28, being amount received from city of Boston, in reimbursement for the Mystic Tunnel Extension.

The foregoing receipts have been credited to the various objects or works, as follows: —

Sources of Receipts.	For the Year ending December 31, 1912.		From Beginning of Work to December 31, 1912.	
Admission into Metropolitan Water District (Quincy, Nahant, Arlington, Stoneham, Milton, Lexington and Swampscott),	-		$182,265 00	
Supplying water to cities and towns outside of Water District (Swampscott, Revere, Lexington, Wakefield, Cambridge, Framingham, Westborough State Hospital, Worcester and U. S. Government), and to water companies (Framingham, Milton and Revere),	$9,150 17		169,369 86	
		$9,150 17		$351,634 86
Amounts carried forward,	. . .	$9,150 17		$351,634 86

Sources of Receipts.	For the Year ending December 31, 1912.		From Beginning of Work to December 31, 1912.	
Amounts brought forward,		$9,150 17		$351,634 86
Construction and acquisition of works: —				
Administration,	$19 89		$363 49	
Wachusett Dam,	609 90		7,799 47	
Wachusett Reservoir,	522 00		140,891 11	
Wachusett Aqueduct,	-		5,204 70	
Weston Aqueduct,	-		5,200 13	
Sudbury Reservoir,	-		10,640 42	
Distribution system,	7,737 53		118,735 01	
Diversion of water, Clinton sewerage system,	-		1,389 46	
Purchase of existing water works,	3,110 00		21,229 08	
		11,999 32		311,452 87
Maintenance and operation of works: —				
Administration,	$314 08		$660 50	
General supervision,	1,028 46		3,033 47	
Wachusett Aqueduct,	279 39		7,318 72	
Wachusett Reservoir,	7,385 18		48,034 39	
Power plant,	27,843 37		34,994 13	
Sudbury system,	1,810 98		21,572 09	
Distribution system,	49,205 67		89,985 37	
Clinton sewerage system,	148 35		5,963 41	
		88,015 48		211,562 08
Total receipts,		$109,164 97		$874,649 81

(*c*) *Assets.*

The following is an abstract of the assets of the Water Works, a complete schedule of which is kept on file in the office of the Board: —

Office furniture, fixtures and supplies; engineering and scientific instruments and supplies; police supplies; horses, vehicles, field machinery, etc.; machinery, tools and other appliances and supplies; real estate connected with works not completed; completed works, including real estate and buildings connected therewith.

(*d*) *Liabilities.*

The sums due on monthly pay rolls amount to $1,453.05, and there are bills for current expenses which have not yet been received.

Amounts on Monthly Estimates, not due until Completion of Contracts or until Claims are settled.

NAME.	Work.	Amount.
McBride & Co.,	Contract 283, Stillwater improvement, Wachusett Reservoir.	$778 09[1]
Camoia & Williams,	Contract 308, Section 33 of northern high-service pipe lines, Distribution System.	200 00
De Vincenzi & Baruffoldi,	Contract 322, Section 36 of northern extra high-service pipe lines, Distribution System.	100 00
Joseph Hanreddy,	Contract 314, Section 7 of the Weston Aqueduct Supply Mains.	10 00
Holly Manufacturing Co.,	Contract 312, pumping engine for Chestnut Hill low-service pumping station.	1,709 00
A. Varnerin Co.,	Contract 347, for building the superstructure of the southern extra high-service pumping station at Hyde Park, Boston, Mass.	3,058 52
Laidlaw-Dunn-Gordon Co.,	Contract 346, for furnishing two pumping engines for the southern extra high-service pumping station at Hyde Park, Boston, Mass.	11,423 50

[1] Held pending settlement of claims on account of this contract.

It is impossible to state the amounts due on the claims of the following for land damages, for water rights taken and for damages to established business, as no sums have been agreed upon, and suits are now pending in court for the determination of most of them: —

Patrick Bradley, Henry F. Keyes, James E. Welch, Byron D. Allen, J. Frank Wood *et al.,* Asa Knight, Edward F. Merriam, Sanford C. Kendall, estate of William H. Vickery, James H. and Hannah S. Wood, Francis W. M. Goodale, heirs of Willard Morse, Caroline R. Braman, Charles G. Rice, Nehemiah W. Rice *et al.*, John Ward *et al.,* heirs of George K. Ward.

VI. METROPOLITAN SEWERAGE WORKS.

The North Metropolitan Sewerage District embraces the cities of Cambridge, Chelsea, Everett, Malden, Medford, Melrose, Somerville and Woburn, and the towns of Arlington, Belmont, Revere, Stoneham, Wakefield, Winchester and Winthrop, and parts of the city of Boston and the town of Lexington, — comprising in all 9 cities and 8 towns, with an area of 90.50 square miles. The District has an estimated population, based upon the United States Census of 1910, as of December 31, 1912, of 558,140. Of the total population it is estimated that 89 per cent., or 496,795 people, contribute sewage to the North Metropolitan System.

The South Metropolitan Sewerage District includes the cities of Newton, Quincy and Waltham, and the towns of Brookline, Milton and Watertown, and parts of the city of Boston (including the former town of Hyde Park) and the town of Dedham, — a total of 4 cities and 4 towns. This district has an area of 100.87 square miles, with an estimated population as of December 31, 1912, of 381,840. According to the estimates made 66.1 per cent. of this population, or 252,265, contribute sewage to the South Metropolitan System.

(1) NORTH METROPOLITAN SEWERAGE SYSTEM — CONSTRUCTION.

The amount expended for construction on account of the North Metropolitan Sewerage System during the past year was $53,104.32. A portion of this amount was paid on account of the Malden and Everett sewer extension which had been completed in the preceding year.

The Legislature of 1912 authorized the Board to construct an additional main sewer in the Mystic valley, and also to provide new screening machinery in connection with the East Boston sewerage pumping station and the acquisition of additional land for the purpose. Authorization was given for the issue of an additional sewerage loan to an amount not exceeding $378,000.

(a) *New Mystic Sewer.*

The Board was authorized to construct an additional main sewer in the Mystic valley, extending from a point in the old Mystic valley sewer, near the boundary line between the city of Woburn and the town of Winchester, and running through the town of Winchester and a part of the city of Medford to a point in the Metropolitan main sewer a little below its junction with the old Mystic valley sewer, a length of about 3.4 miles.

The making of surveys and borings was begun immediately after the passage of the act of last year and a contract was made on October 15, 1912, for the construction of 4,800 feet at the lower end of the proposed sewer. The work upon this section has since been carried on successfully, and it is estimated that about 20 per cent. of the section has so far been completed. It is expected that the necessary work preliminary to the making of contracts for the remaining sections of the sewer will be completed in the early part of the year, and that work throughout the entire length will be undertaken before the close of the year. As the route passes through the central portion of the town of Winchester and along the Aberjona River the construction of a portion of its length is attended with considerable difficulty.

(*b*) *New Screening Works at East Boston Pumping Station.*

The Board was also authorized to provide new screening machinery in connection with the East Boston sewerage pumping station and to take such additional land as might be necessary in connection with the installation of such machinery. A taking for the extension of the pumping station in which the machinery should be installed was made of about 1,715 square feet of land lying directly south of the pumping station lot. A contract has been made for the erection of the building addition, and the work under it is about to be begun. Plans have been nearly completed for the new screening machinery which will be called for. Considerable preliminary work has already been undertaken. The present screens at this station are located underground in very contracted quarters, and the care of them has been attended with much difficulty and inconvenience. By the change the screens will be operated from the ground level and a great sanitary as well as mechanical improvement will be effected.

(*c*) *Siphon under Metropolitan Sewer in East Boston.*

The city of Boston in extending its sewerage system was compelled to carry a siphon under the Metropolitan sewer in Saratoga Street. As the work involved much difficulty and the use of compressed air, as well as considerable danger to the Metropolitan sewer during construction, it was desired by the city of Boston that the construction of the new siphon under the sewer should be undertaken by the Board. The siphon was, however, completed with entire success and the city of Boston has reimbursed the Commonwealth for the expense incurred, which amounted to $9,689.46.

(2) SOUTH METROPOLITAN SEWERAGE SYSTEM — CONSTRUCTION.

No considerable work was undertaken during the past year on the South Metropolitan Sewerage System. Expenditures on account of construction were $7,258.87. The larger part of this sum was for a final payment on account of an old contract upon the High-level Sewer extension and on account of settlement for land taken for the same purpose.

(3) Acquisition of Land and Settlements.

The Board acquired by taking 0.0393 of an acre in fee for the extension of the screen-house at the East Boston pumping station, and easements in 2.135 acres in Medford and Winchester for the construction of the new Mystic Sewer.

One settlement for easements in land previously taken was made, for which $2,350 was paid.

The following is a list of the takings made during the year for the Sewerage Works: —

Takings for Metropolitan Sewerage Works for the Year 1912.

No.	Location and Description.	Former Owner.	Recorded.	Purpose of Taking.
27	East Boston, — Land in Addison Street, a private way. Area, fee in 1,715 square feet.	East Boston Company,	1912. July 20.	Installation of screening machinery.
28	Medford and Winchester, — Strip of land 20 feet wide for the most part and 15 feet at the northerly end. Area, sewer easements in 2.135 acres.	Boston & Maine Railroad, Robert Bacon and Charles F. Bacon, Jacob W. Wilbur and streets.	Oct. 15.	New Mystic sewer.

(4) North Metropolitan Sewerage System — Maintenance.

The cost of the maintenance and operation of the North Metropolitan Sewerage System during the past year was $155,303.15.

(a) *Sewers and Pumping Stations.*

The Metropolitan sewers in the North Metropolitan System now extend a distance of 60.01 miles, and the local sewers which are connected with the Metropolitan sewers have a further length of 700.25 miles, involving 74,376 connections.

The sewage which is collected in the various branches of the North Metropolitan System flows at first by gravity, but subsequently before being finally disposed of is necessarily lifted at different points by pumping, most of it at least twice and portions of it three times. All of the sewage of the North Metropolitan System is discharged into the harbor from an outfall which is placed about 1,900 feet off Deer Island.

The daily average amount of sewage discharged into the harbor was 55,700,000 gallons, a daily average for each individual contributing sewage of 112.1 gallons. The increase in the total amount of sewage discharged was 2,900,000 gallons per day more than the discharge of the preceding year. The maximum discharge of sewage in any one day was, at a time of severe storm, 151,800,000 gallons.

The pumping stations operated for the North Metropolitan Sewerage System are as follows: —

	Number of Engines.	Contract Capacity per Day (Gallons).	Lift (Feet).
Deer Island Station (Boston harbor),	4	235,000,000	19
East Boston Station,	4	235,000,000	19
Charlestown Station,	3	104,000,000	11 8
Alewife Brook Station (Somerville),	3	22,000,000	13

There were obtained for the operation of the pumping stations 6,591.633 tons of bituminous coal which, purchased at average prices at the different stations, varied from $3.87 to $4.45 per gross ton delivered in the bins.

The sums expended for the labor of engineers and their assistants in the various pumping stations of the district amounted to $63,215.73 and for fuel amounted to $22,509.16. The total expenditure for the operation of the stations was $101,825.53.

The average cost per million gallons of sewage lifted per foot at the several stations was $0.135.

Some special operations were called for in addition to the ordinary maintenance and care of the sewers and pumping stations and their appurtenances.

It became necessary to provide a new economizer for the Charlestown pumping station and to reset the old boilers. The boilers themselves, which had been in operation 12 and 17 years respectively, were after careful inspection found to be in good condition.

Considerable dredging was required alongside the wharf in Chelsea Creek at the East Boston pumping station in order to facilitate the handling of coal received at this station.

The work of carrying the railroad over Medford Street in Somerville and under Saratoga Street at Orient Heights in East Boston, through which the Metropolitan sewer was laid, undertaken for the abolition of grade crossings, required constant inspection and care on the part of the engineering force. Both of these undertakings, however, were accomplished without injury to the sewer.

(b) *Tanneries and Gelatine and Glue Works.*

A special force has been required for the oversight and care of the Mystic valley sewers which receive the sewage and waste material discharged from the tanneries and other manufactories in Winchester, Woburn and Stoneham. Under the requirements of the Board substantially all the tanneries and other manufactories have installed settling tanks in which the most objectionable matter is deposited before the contents are allowed to enter the sewers. The semi-liquid sludge removed from these tanks for disposal elsewhere amounts in the year to about 7,924 cubic yards. The inspection of the various establishments and the enforcement of the regulations of the Board involve a large expense to the District.

(5) SOUTH METROPOLITAN SEWERAGE SYSTEM — MAINTENANCE.

The entire cost of maintenance of the South Metropolitan Sewerage System during the past year has been $102,454.57.

Sewers and Pumping Stations.

The Metropolitan sewers in the South Metropolitan Sewerage System, which comprise the old Charles River valley sewer and Neponset River valley sewer, as well as the new High-level Sewer and extension, have a total length of 43.42 miles and with these are connected local sewers having a length of 572.40 miles, involving 36,215 connections.

The pumping stations operated for the South Metropolitan Sewerage System are as follows: —

	Number of Engines.	Contract Capacity per Day (Gallons).	Lift (Feet).
Ward Street Station (Roxbury District),	2	100,000,000	45
Quincy Station,	3	18,000,000	28
Quincy Sewerage Lifting Station,	2	3,000,000	20

The sewage of two small districts in Dorchester and Milton, included in the Neponset River valley system, which are too low for sewage to be delivered into the High-level Sewer by gravity, is, under an arrangement with the city of Boston, disposed of through the Boston Main Drainage Works at Moon Island. By this arrangement the Board is relieved from the expense of providing extra pumping facilities.

The larger part of the sewage of the District is lifted into the High-level Sewer at the Ward Street pumping station in Roxbury, but the sewage of the city of Quincy is pumped into the sewer at Greenleaf Street near the Quincy pumping station. The entire sewage is screened at the Nut Island screen-house for the purpose of intercepting solid matter, and is thence discharged at the bottom of the harbor from the two outfalls about a mile off from the Island.

The average daily amount of sewage thus discharged was 48,200,000 gallons, and the largest discharge in a single day was 135,000,000 gallons. The increase in the daily average from last year was 6,200,000 gallons.

The daily average discharge of sewage for each individual contributing sewage in the District was 191 gallons.

There were 2,986.195 gross tons of bituminous coal obtained at the two pumping stations and screen-house which, purchased at average prices, varied from $4.10 to $4.56 per gross ton delivered in the bins.

The expenditures for the labor of the engineers and their assistants at the three stations amounted to $36,993.82, and the expenditures for fuel amounted to $11,346.71. The total amount expended for the operation of the stations was $54,972.08.

VII. SEWERAGE WORKS — FINANCIAL STATEMENT.

The financial abstract of the receipts, expenditures, disbursements, assets and liabilities of the Metropolitan Water and Sewerage Board for the fiscal year of the Commonwealth ending with the thirtieth day of November, 1912, was, as stated in connection with the Water Works, presented to the General Court in January, in accordance with the requirements of chapter 235 of the Acts of the year 1906, and a copy of this financial abstract is in part printed as Appendix No. 6.

The following statement of its financial doings, in relation to the Metropolitan Sewerage Works, for the calendar year 1912 is herewith presented, in accordance with the provisions of the Act of 1906, as a part of the annual report of the Board.

The Metropolitan Sewerage Loans authorized for the construction of the Sewerage Works of the North Metropolitan System have amounted to $7,013,865.73, to which are added receipts from various sources amounting to $75,444.12. The amount of expenditures approved by the Board for payment for the year 1912 was $53,104.32. This amount includes the sum of $9,689.46 expended for the Saratoga Street Culvert in East Boston, for which the city of Boston reimbursed the Commonwealth, and the sum received was applied to the credit of the Loan Fund. The total amount of expenditures approved to January 1, 1913, was $6,739,995.82. The balance remaining on January 1, 1913, was $349,314.03.

The loans authorized for the construction of the various parts of the South Metropolitan System have amounted to $8,867,046.27. The receipts applicable to the Loan Fund have been $14,004.60. The amount of expenditures approved for payment in the year 1912 was $7,258.87. The total amount of expenditures approved for payment from the beginning of the works has been $8,820,491.40. The balance remaining for the South Metropolitan System on January 1, 1913, was $60,559.47.

The bonds issued on account of the loans have been for varying periods, not exceeding forty years, and bear interest at the rate of 3 per cent. and 3½ per cent. The premiums received on account of the sale of bonds for the North Metropolitan System have amounted to $179,763.73 and those received on account of the South Metropolitan System have amounted to $410,132.03.

As there has been no increase in the debt during the calendar year, as represented by the Metropolitan Sewerage Loans, and the increase of the sinking fund for the payment of the debt at maturity was for the same period $273,866.22, there has been a consequent decrease in the net debt during the calendar year amounting to $273,866.22.

The amount expended for maintenance of the North Metropolitan System in the year 1912 was $155,303.15 and for the South Metropolitan System $102,454.57, a total for both systems of $257,757.72.

The assessments made to meet interest, sinking fund requirements and maintenance and operation of the North Metropolitan System amounted in the year 1912 to $472,968.75 and the assessments for the South Metropolitan System amounted to $477,418.59.

The following is a detailed financial statement regarding the Metropolitan Sewerage Works: —

(1) Metropolitan Sewerage Loans, Receipts and Payments.

The loans authorized for the construction of the Metropolitan Sewerage Works, the receipts which are added to the proceeds of these loans, the expenditures for construction, and the balance available on January 1, 1913, have been as follows: —

(a) *North Metropolitan System.*

Loans authorized under various acts prior to 1912 for the construction of the North Metropolitan System and the various extensions,	$6,635,865 73	
Loan authorized under chapter 461 of the Acts of 1912 for the New Mystic Sewer and new screen equipment at the East Boston pumping station, ...	378,000 00	
		$7,013,865 73
Receipts from sales of real estate and from miscellaneous sources which are placed to the credit of the North Metropolitan System: —		
For the year ending December 31, 1912, .	$10,883 48	
For the period prior to January 1, 1912, .	64,560 64	
		75,444 12
		$7,089,309 85
Amount approved for payment by the Board[1] out of the Metropolitan Sewerage Loan Fund, North System: —		
For the year ending December 31, 1912, .	$53,104 32	
For the period prior to January 1, 1912, .	6,686,891 50	
		6,739,995 82
Balance, North Metropolitan System, January 1, 1913, .		$349,314 03

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[1] The word "Board" refers to the Metropolitan Sewerage Commission and the Metropolitan Water and Sewerage Board.

(b) *South Metropolitan System.*

Loans authorized under the various acts, applied to the construction of the Charles River valley sewer, Neponset valley sewer, High-level sewer and extension, constituting the South Metropolitan System,			$8,867,046 27
Receipts from pumping, sales of real estate and from miscellaneous sources, which are placed to the credit of the South Metropolitan System: —			
For the year ending December 31, 1912,		$372 09	
For the period prior to January 1, 1912,		13,632 51	
			14,004 60
			$8,881,050 87
Amount approved by the Board[1] for payment out of the Metropolitan Sewerage Loan Fund, South System: —			
On account of the Charles River valley sewer,		$800,046 27	
On account of the Neponset valley sewer,		911,531 46	
On account of the High-level sewer and extension: —			
For the year ending December 31, 1912,	$7,258 87		
For the period prior to January 1, 1912,	7,101,654 80		
		7,108,913 67	
			8,820,491 40
Balance, South Metropolitan System, January 1, 1913,			$60,559 47

(2) ISSUES OF METROPOLITAN SEWERAGE LOAN BONDS.

The Treasurer of the Commonwealth, under the authority of the successive statutes, has from time to time issued bonds designated "Metropolitan Sewerage Loan" amounting for the North System to $6,625,000, and for the South System to $8,877,912. The bonds sold prior to the year 1912, amounting to $6,563,000 for the North System and $8,877,912 for the South System, were sinking fund bonds. A list of these bonds sold is given in the 9th and 10th Annual Reports. The bonds sold in the year 1912 were serial bonds, amounting to $62,000, bearing interest at 3½ per cent. per annum, as follows: —

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[1] The word "Board" refers to the Metropolitan Sewerage Commission and the Metropolitan Water and Sewerage Board.

DATE OF SALE.	Amount of Bonds sold.	Price received.	Premium.	Date Due.
Jan. 29, 1912, ...	$62,000	$100.349	$216.38	$3,000 each year, Jan. 1, 1913, to Jan. 1, 1916, inclusive; $2,000 each year, Jan. 1, 1917, to Jan. 1, 1941, inclusive.

The bonds amounting to $62,000 stated in the 11th Annual Report as sold on July 20, 1911, were temporary loans for which permanent provision was made by the sale of January 29, 1912.

(3) METROPOLITAN SEWERAGE LOANS SINKING FUND.

Under the authority of chapter 122 of the Acts of the year 1899 the Treasurer and Receiver-General of the Commonwealth was required to consolidate the sinking funds of all the Metropolitan Sewerage Loans into one fund, to be known as the Metropolitan Sewerage Loans Sinking Fund.

The Board received during the year, from rentals and from other sources, to be applied to the sinking fund, $200.33.

The sinking fund established has amounted at the end of each year to sums as follows: —

December 31, 1899, .	$361,416 59
December 31, 1900, .	454,520 57
December 31, 1901, .	545,668 26
December 31, 1902, .	636,084 04
December 31, 1903, .	754,690 41
December 31, 1904, .	878,557 12
December 31, 1905, .	1,008,724 95
December 31, 1906, .	$1,146,998 68
December 31, 1907, .	1,306,850 30
December 31, 1908, .	1,492,418 98
December 31, 1909, .	1,673,784 40
December 31, 1910, .	1,931,741 89
December 31, 1911, .	2,184,674 98
December 31, 1912, .	2,458,541 20

(4) ANNUAL APPROPRIATIONS, RECEIPTS AND EXPENDITURES.

The annual appropriations for the maintenance of the Metropolitan Sewerage Works, the receipts of the Board which are added to the appropriations for maintenance, and the expenditures for maintenance for the year ending December 31, 1912, have been as follows: —

North Metropolitan System.

Appropriation under chapter 132 of the Acts of 1912, . . .	$160,500 00
Receipts from pumping and from other sources, ...	740 71
	$161,240 71
Amount approved by the Board for payment, ...	155,303 15
Balance, January 1, 1913, ...	$5,937 56

South Metropolitan System.

Appropriation under chapter 146 of the Acts of 1912,	$107,550 00
Receipts from pumping and from other sources,	251 70
	$107,801 70
Amount approved by the Board for payment,	102,454 57
Balance, January 1, 1913,	$5,347 13

(5) ANNUAL ASSESSMENTS.

Assessments for the year, amounting to $472,968.75 for the North Metropolitan System and to $477,418.59 for the South Metropolitan System, were required for the payment of interest and sinking fund requirements and the cost of maintenance and operation of works. The requirements for the North Metropolitan System were, for interest, $202,426.20; for the sinking fund, $114,321; and for maintenance, $156,221.55. For the South Metropolitan System the requirements were, for interest, $301,960.07; for the sinking fund, $70,055; and for maintenance, $105,403.52. The assessments for both the North and South Metropolitan systems were made upon the cities and towns in the District in accordance with chapter 369 of the Acts of the year 1906. The respective assessments were as follows: —

North Metropolitan Sewerage System.

Arlington,	$11,166 80
Belmont,	6,122 08
Boston,	79,330 28
Cambridge,	105,568 39
Chelsea,	26,283 29
Everett,	27,799 37
Lexington,	4,291 41
Malden,	42,546 70
Medford,	22,710 68
Melrose,	15,804 48
Revere,	$15,635 77
Somerville,	65,629 12
Stoneham,	5,466 51
Wakefield,	9,708 90
Winchester,	11,776 36
Winthrop,	10,981 06
Woburn,	12,147 55
Total,	$472,968 75

South Metropolitan Sewerage System.

Boston,	$206,607 49
Brookline,	86,141 28
Dedham,	11,806 49
Hyde Park,	14,538 32
Milton,	22,109 46
Newton,	65,065 35
Quincy,	$29,944 04
Waltham,	27,160 76
Watertown,	14,045 40
Total,	$477,418 59

(6) Expenditures for the Different Works.

The following is a summary of the expenditures made in the various operations for the different works: —

Construction and Acquisition of Works.	For the Year ending December 31, 1912.		From Beginning of Work to December 31, 1912.	
North Metropolitan System.				
Original system, main line and branches,		-		$5,383,957 67
Lexington branch,		-		68,585 15
Everett branch,		-		54,877 12
Wakefield branch,		-		35,698 29
Stoneham branch,		-		11,574 10
Revere extension,		-		215,722 79
Chelsea and Everett outlets,		-		71,216 41
Wakefield branch extension,		-		190,081 97
Belmont extension,		-		57,363 06
Malden extension,		-		67,092 63
Bulkhead, Chelsea creek,		-		3,231 00
North System, enlargement: —				
Administration,	$2,199 24		$15,417 29	
Deer Island pumping station, extensions and additions,	-		195,373 14	
East Boston pumping station, extensions and additions,	18,457 70		260,895 97	
Malden-Everett extension, Sections 65 and 66,	5,535 20		63,305 90	
Stable and locker, East Boston,	-		18,691 15	
New Mystic sewer,	17,222 72		17,222 72	
Saratoga Street culvert, East Boston,	9,689 46		9,689 46	
		$53,104 32		580,595 63
Total for North Metropolitan System,	. . .	$53,104 32		$6,739,995 82
South Metropolitan System.				
Charles River valley sewer, main line,		-		$800,046 27
Neponset River valley sewer: —				
Main line,	-		$866,595 66	
Brookline branch,	-		44,935 80	
		-		911,531 46
High-level Sewer,	. . .	$180 38		5,992,840 39
High-level Sewer extension: —				
Charles River valley studies,	-		$3,893 71	
Administration,	$1,139 95		17,595 76	
Section 80, day work, West Roxbury and Brookline,	48 60		295,265 01	
Section 81, Brookline,	-		129,519 35	
Section 82, Brookline,	-		136,152 02	
Section 82, day work, Park Street crossing,	-		2,030 18	
Section 83, Brookline,	-		94,065 87	
Amounts carried forward,	$1,188 55	$180 38	$678,521 90	$7,701,418 12

CONSTRUCTION AND ACQUISITION OF WORKS.	For the Year ending December 31, 1912.		From Beginning of Work to December 31, 1912.	
Amounts brought forward,	$1,188 55	$180 38	$678,521 90	$7,704,418 12
South Metropolitan System — Con.				
High-level Sewer extension — *Con.*				
Section 84, Brookline and Brighton,	-		47,592 89	
Section 85, Brighton,	3,447 55		230,826 05	
Section 85, day work, Brighton,	-		66,611 62	
Section 86, Brighton,	-		57,864 88	
Quincy sewage lifting station,	65 00		24,109 60	
Land takings, purchase and recording,	2,377 39		10,546 34	
		7,078 49		1,116,073 28
Total for South Metropolitan System,	. . .	$7,258 87		$8,820,491 40
Total for construction, both systems,	. . .	$60,363 19		$15,560,487 22

MAINTENANCE.	For the Year ending December 31, 1912.	From Beginning of Work to December 31, 1912.
North Metropolitan System,	$155,303 15	$2,041,039 44
South Metropolitan System,	102,454 57	1,613,920 94
Total for maintenance, both systems,	$257,757 72	$3,654,960 38

(7) DETAILED FINANCIAL STATEMENT.

The Board herewith presents, in accordance with the Metropolitan Sewerage acts, an abstract of the expenditures and disbursements, receipts, assets and liabilities for the year ending Dec. 31, 1912: —

(*a*) *Expenditures and Disbursements.*

GENERAL CHARACTER OF EXPENDITURES.	For the Year ending December 31, 1912.
CONSTRUCTION OF WORKS AND ACQUISITION BY PURCHASE OR TAKING.	
North Metropolitan System.	
Administration: —	
Commissioners,	$416 67
Secretary,	375 00
Clerks and stenographers,	1,048 90
Amount carried forward,	$1,840 57

General Character of Expenditures.	For the Year ending December 31, 1912.	
Amount brought forward,	$1,840 57	
North Metropolitan System — Con.		
Administration — *Con.*		
Traveling,	-	
Stationery, printing and office supplies,	159 88	
Telephone, lighting, heating, water and care of building,	104 55	
Rent and taxes, main office,	84 59	
Repairs of building,	9 65	
Miscellaneous expenses,	-	
		$2,199 24
Engineering: —		
Chief engineer,	$600 00	
Engineering assistants,	4,406 50	
Inspectors,	633 90	
Traveling expenses,	129 46	
Stationery, printing and office supplies,	88 86	
Engineering and drafting instruments and tools,	72 02	
Engineering and drafting supplies,	45 58	
Telephone, lighting, heating, water and care of building,	313 70	
Rent and taxes,	253 79	
Repairs of building,	28 96	
Miscellaneous expenses,	42 60	
		6,615 37
Advertising,	$25 43	
Labor and teaming,	16,457 15	
Tools, machinery and appliances,	1,761 96	
Brick, cement, lumber and other field supplies and expenses,	7,102 69	
		25,347 23
Contracts: —		
A. G. Tomasello, contract 81, for constructing Section 66 (Malden-Everett extension) of the North Metropolitan Sewerage System in Malden,	$5,502 70	
Allis-Chalmers Company, contract 73, addition to pumping plant at East Boston pumping station,	3,600 00	
Coleman Bros., contract 99, for constructing Section 67 (New Mystic Sewer) of the North Metropolitan Sewerage System in Medford and Winchester,	9,817 64	
		18,920 34
Real estate: —		
Legal, conveyancing and expert,	$22 14	
		22 14
Total for North Metropolitan System,		$53,104 32
South Metropolitan System.		
High-level Sewer.		
Engineering: —		
Engineers, inspectors, rodmen, laborers and others,	$180 38	
		$180 38
Amount carried forward,		$180 38

GENERAL CHARACTER OF EXPENDITURES.	For the Year ending December 31, 1912.	
Amount brought forward,	. . .	$180 38
***South Metropolitan System* — Con.**		
High-level Sewer Extension.		
Administration: —		
Commissioners,	$750 00	
Clerks and stenographers,	206 67	
Stationery, printing and office supplies,	105 77	
Telephone, lighting, heating, water and care of building,	30 39	
Rent and taxes, main office,	42 30	
Repairs of building,	4 82	
		1,139 95
Engineering: —		
Telephone, lighting, heating, water and care of building,	$91 17	
Rent and taxes,	126 90	
Repairs of building,	14 48	
		232 55
Brick, cement, lumber and other field supplies and expenses,	$28 60	
		28 60
Contracts: —		
George M. Bryne Company, for constructing Section 85, in part,	$3,300 00	
		3,300 00
Real estate: —		
Settlements,	$2,350 00	
Legal, conveyancing and expert,	27 39	
		2,377 39
Total for South Metropolitan System,	. . .	$7,258 87
MAINTENANCE AND OPERATION OF WORKS.		
North Metropolitan System.		
Administration: —		
Commissioners,	$2,333 32	
Secretary and assistants,	3,477 32	
Rent,	281 99	
Heating, lighting and care of building,	263 66	
Repairs of building,	35 46	
Postage,	118 00	
Printing, stationery and office supplies,	561 11	
Telephones,	45 75	
Traveling expenses,	44 11	
Miscellaneous expenses,	2 75	
		$7,163 47
General supervision: —		
Chief engineer and assistants,	$4,834 36	
Rent,	846 00	
Amounts carried forward,	$5,680 36	$7,163 47

General Character of Expenditures.	For the Year ending December 31, 1912.	
Amounts brought forward,	$5,680 36	$7,163 47
North Metropolitan System — Con.		
General supervision — *Con.*		
Heating, lighting and care of building,	791 19	
Repairs of building,	106 37	
Postage,	-	
Printing, stationery and office supplies,	70 15	
Telephones,	137 21	
Traveling expenses,	50 00	
Miscellaneous expenses,	-	
		6,835 28
Deer Island pumping station: —		
Labor,	$16,582 32	
Fuel,	7,577 17	
Oil and waste,	487 33	
Water,	1,594 80	
Packing,	103 73	
Repairs and renewals,	845 83	
Telephones,	106 92	
General supplies,	965 81	
Miscellaneous supplies and expenses,	120 24	
		28,384 15
East Boston pumping station: —		
Labor,	$22,425 68	
Fuel,	8,151 25	
Oil and waste,	541 10	
Water,	2,226 00	
Packing,	131 69	
Repairs and renewals,	727 38	
Telephones,	66 38	
General supplies,	1,196 46	
Miscellaneous supplies and expenses,	3,189 31	
		38,655 25
Charlestown pumping station: —		
Labor,	$15,838 73	
Fuel,	5,032 42	
Oil and waste,	318 24	
Water,	562 80	
Packing,	37 34	
Repairs and renewals,	1,312 32	
Telephones,	46 60	
General supplies,	568 33	
Miscellaneous supplies and expenses,	80 58	
		23,797 36
Alewife Brook pumping station: —		
Labor,	$8,369 00	
Fuel,	1,748 32	
Oil and waste,	230 91	
Water,	211 32	
Amounts carried forward,	$10,559 55	$104,835 51

GENERAL CHARACTER OF EXPENDITURES.	For the Year ending December 31, 1912.	
Amounts brought forward,	$23,930 19	$67,013 84
South Metropolitan System — Con.		
Sewer lines, buildings and grounds — *Con.*		
Castings, ironwork and metals,	68 09	
Freight, express and teaming,	25	
Fuel and lighting,	154 22	
Jobbing and repairing,	17 60	
Lumber,	282 31	
Machinery, tools and appliances,	87 76	
Paints and oils,	341 61	
Rubber and oiled goods,	93 09	
Sand, gravel and stone,	11 00	
Telephones,	33 60	
Traveling expenses,	486 76	
General supplies,	217 73	
Miscellaneous expenses,	72 00	
		25,796 21
City of Boston, for pumping and interest,	. . .	6,423 73
Horses, vehicles and stable account,	. . .	3,220 79
Total for South Metropolitan System,	. . .	$102,454 57

(*b*) *Receipts.*

The receipts from the sales of property, from rents and from other sources, have been credited as follows: —

ACCOUNT.	For the Year ending December 31, 1912.	From Beginning of Work to December 31, 1912.
North Metropolitan System — construction,	$10,883 48[1]	$75,444 12
South Metropolitan System — construction,	372 09	14,004 60
North Metropolitan System — maintenance,	740 71	15,739 37
South Metropolitan System — maintenance,	251 70	2,360 36
Metropolitan Sewerage Loans Sinking Fund,	200 33	2,002 92
Totals,	$12,448 31	$109,551 37

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[1] Included in this amount is the sum of $9,960.14, being amount received from city of Boston, in reimbursement for construction of Saratoga Street Culvert in East Boston.

(*c*) *Assets.*

The following is an abstract of the assets of the Sewerage Works, a complete schedule of which is kept on file in the office of the Board: —

Office furniture, fixtures and supplies; engineering and scientific instruments and supplies; horses, vehicles, field machinery, etc.; machinery, tools and other appliances and supplies; real estate connected with works not completed; completed works, including real estate connected therewith.

(*d*) *Liabilities.*

The sums due on monthly pay rolls amount to $755 and there are bills for current expenses which have not yet been received.

Amounts on Monthly Estimates, not due until Completion of Contracts or until Claims are settled.

Name.	Work.	Amount.
High-level Sewer: —		
National Contracting Co., . .	Sect. 73, contract abandoned, ...	$5,516 17[1]
E. W. Everson & Co., . . .	Sect. 75, contract 14, ...	1,000 00
High-level Sewer Extension: —		
Timothy J. O'Connell, . .	Sect. 82, in part, contract 57, ...	60 00
North Metropolitan Construction:—		
Coleman Bros., . . .	Sect. 67, New Mystic Sewer, contract 99, . . .	1,732 53

[1] Damages claimed by the Commonwealth on account of the abandonment of the contract exceed this amount.

Claims have been made by the following parties, but it is impossible to state the amounts due for land and other damages, as no sums have been agreed upon, and suits are now pending in the courts for the determination of most of them: —

Anna L. Dunican, Carrie S. Urquhart, N. Jefferson Urquhart, Edwin N. Urquhart, Richard Jones, James Doherty, Michael Niland, William H. Gibbons, Francis Normile, Robert Bacon, Jacob W. Wilbur, Boston & Maine Railroad, Robert and Charles F. Bacon, East Boston Company.

VIII. RAINFALL AND WATER SUPPLY.

The past year added still another to the series of years of rainfall below the average, although the amount was considerably larger than in the preceding year. The rainfall on the Wachusett watershed during the year 1912 was 40.19 inches, and on the Sudbury watershed 40.72 inches, while the average for the periods covered by the records has been respectively 46.13 inches and 45.01 inches.

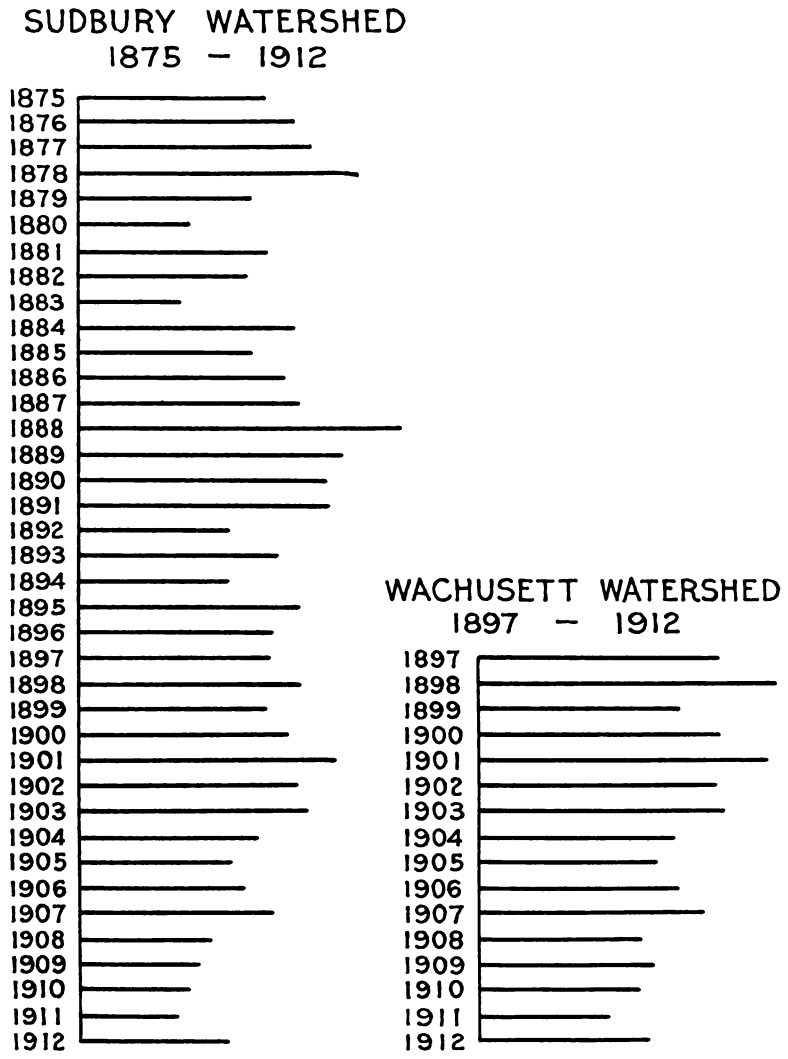
The Wachusett watershed yielded for consumption a daily average per square mile of 891,000 gallons, while the average for the 16 years during which the measurements have been made has been 1,094,000; and the Sudbury watershed yielded a daily average of 779,000 gallons, the daily average per square mile having been 1,007,000 gallons during the 37 years for which records have been kept. The amount of water collected from these two watersheds from which the water is principally drawn for the supply of the Metropolitan District was respectively 81.44 per cent. and 77.35 per cent. of the average amount collected in the series of years.

The quantity of water collected for the water supply during the series of years in the two watersheds is indicated upon the accompanying diagram.

IX. CONSUMPTION.

During the past year the quantity of water supplied to the Metropolitan District amounted to a daily average of 116,230,700 gallons, which was equivalent to 107 gallons for each person in the district supplied. This quantity exceeded by 6,235,900 gallons the average daily consumption of the preceding year. About 1,000,000 gallons of this increase was due to the supply afforded for the first time to the district of Hyde Park, but the intensely cold weather which prevailed in the first three months of the year would account for all of the increase which occurred. In this period, owing to the continuous drawing of the water to prevent the freezing of the pipes, the consumption reached the amount of 152,294,000 gallons in a single day, which was 36,064,000 gallons above the average daily consumption for the year. Though this consumption per capita is slightly in excess of that of last year, which was 105 gallons, it is lower than that of any previous year since 1908. These quantities of water furnished to the various cities and towns as measured by the Venturi meters are slightly less than the quantities indicated as delivered to the District by the computation of the amount pumped at the several pumping stations and of the amount flowing in the Weston Aqueduct, on account of the small amount supplied to the pumping stations themselves and outside the District, and that lost by leakage from the distributing reservoirs and pipe mains.

COMPARATIVE AMOUNTS OF WATER COLLECTED IN THE DIFFERENT YEARS ON THE SUDBURY AND WACHUSETT WATERSHEDS PER SQUARE MILE OF WATERSHED



The increase in the average consumption per capita was general throughout the municipalities of the District, there being a slight decrease in only 2 of the municipalities, Medford and Lexington, while in 5 others the average consumption was the same as in the preceding year. The largest increase was in the town of Winthrop, the average daily consumption per capita having increased from 56 gallons in 1911 to 65 gallons in 1912. In Melrose there was an increase of 6 gallons; in Somerville, Malden, Chelsea and Arlington there was an increase of 5 gallons, and in Nahant an increase of 4 gallons.

The fact that notwithstanding the extraordinary cold weather which prevailed in the early part of the year there was but a slight increase in the total consumption of the year is owing largely to the compliance which has taken place with the provisions of the Meter Act of the year 1907.

As stated in the report last year, the cities of Medford and Melrose and the towns of Watertown, Milton, Winthrop, Belmont and Swampscott have meters upon all their services. The city of Chelsea has metered 97.69 per cent., the city of Malden 96.45 per cent. and the town of Arlington 92.97 per cent. of all services. The city of Quincy has again been active in the installation of meters beyond the requirements of the act, it having increased the percentage of its services equipped with meters from 61.98 per cent. in 1911 to 74.98 per cent. in 1912. The town of Stoneham has increased its percentage of services metered from 55.40 per cent. in 1911 to 73.62 per cent. in 1912.

There still, however, continues to be a great waste of water in the Metropolitan District, which the increase in use of meters to a certain extent checks, but which neither the use of meters nor rigorous inspection prevents. The diagram showing the amount of water drawn from the water pipes in the different municipalities between the hours of one and four in the morning is again shown. Water is still drawn between these hours at the rate of more than 68 gallons per day for each inhabitant of the District. The necessary use of water in these hours is comparatively small, but the quantity drawn from the pipes amounts on the average to 63 per cent. of the total average consumption for 24 hours. The waste is principally due to defective local pipes and bad house plumbing and to the constant flow from the faucets in the colder weather; and it is largely preventable by a more rigorous inspection on the part of the authorities of the various municipalities of the District.

The Board is again obliged to urge upon the cities and towns in the Metropolitan District the exercise of stricter supervision and inspection, not only in the interest of economy, but in order that the present sources of supply may be conserved so that new and extensive works shall not be demanded for years to come.

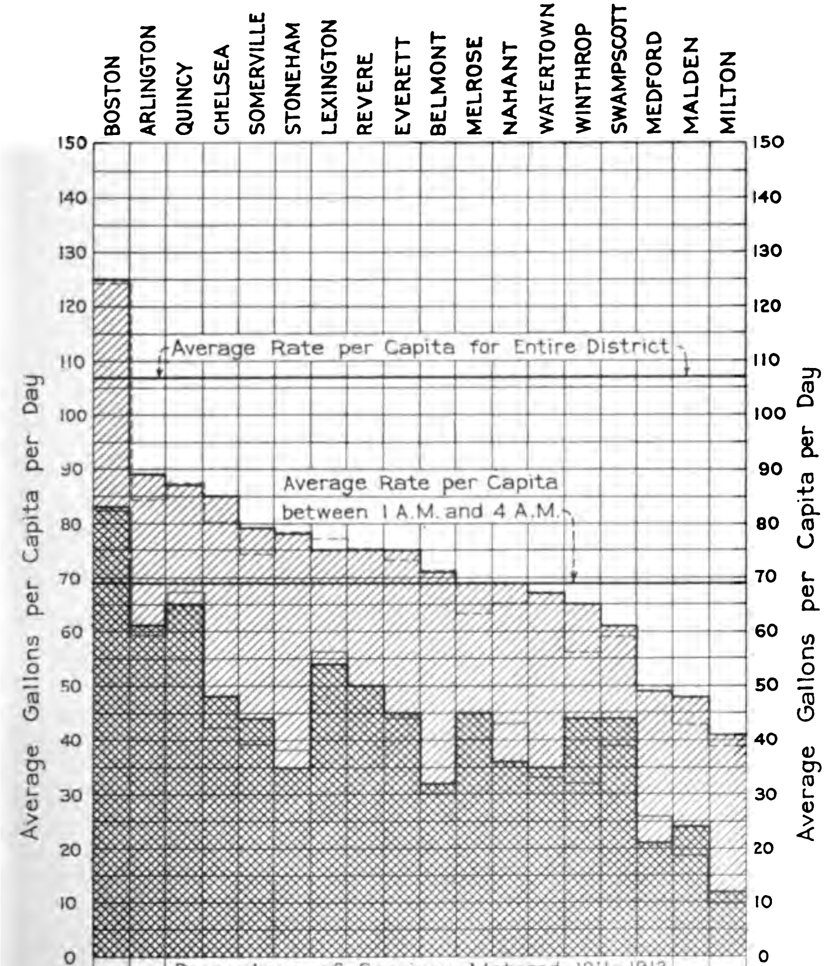
In accordance with certain statutes and arrangements which have been made, water has been supplied to a limited extent outside of the Metropolitan District. The Westborough State Hospital has, during the past year, in accordance with the provisions of a statute, drawn from the open channel of the Wachusett Aqueduct an average daily quantity of 171,445 gallons. The town of Framingham has, likewise, under the provisions of a statute, drawn from Farm Pond an average daily quantity of 787,978 gallons, and directly from the Sudbury Aqueduct 31,694 gallons. The town of Saugus has been supplied through the town of Revere with an average of 17,500 gallons daily. The United States Government, for its use on Peddock's Island, has been supplied with a daily average of 113,900 gallons, and the town of Wakefield, on account of a temporary emergency at the beginning of the year was during a period of 24 days supplied with a total of 13,327,000 gallons. The sums charged for the water thus supplied have amounted to $6,606.67.

X. RECOMMENDATIONS FOR LEGISLATION.

The Board in its preliminary report to the Legislature has not asked for the issue of any additional loans either for the Metropolitan Water Works or for the North or South Metropolitan Sewerage Works. The loans already authorized seem sufficient for the completion of such works as have been authorized and are in progress. The Board has, however, asked for authority to construct during the coming year a short additional branch sewer for the North Metropolitan Sewerage District through a part of the city of Somerville in order properly to dispose of the increased sewage coming from the city of Medford. This request is stated as follows: —

> This relief is urgently called for by the latter city. The proposed new sewer will be 12 inches in diameter and will run parallel with the existing branch sewer through Boston Avenue for a distance of about 600 feet. The estimated cost of the new sewer is less than $3,000. There is a sufficient

DIAGRAM SHOWING
AVERAGE RATE OF CONSUMPTION OF WATER IN THE METROPOLITAN DISTRICT IN 1912
DURING THE ENTIRE DAY
AND
BETWEEN THE HOURS OF 1 AND 4 AT NIGHT



Percentage of Services Metered 1911–1912

	BOSTON	ARLINGTON	QUINCY	CHELSEA	SOMERVILLE	STONEHAM	LEXINGTON	REVERE	EVERETT	BELMONT	MELROSE	NAHANT	WATERTOWN	WINTHROP	SWAMPSCOTT	MEDFORD	MALDEN	MILTON
Dec. 31, 1911	27.3	70.4	62.0	94.3	53.2	55.4	69.7	34.9	28.5	100.0	100.0	50.8	100.0	100.0	100.0	100.0	95.8	100.0
Dec. 31, 1912	34.8	93.0	75.0	97.7	56.9	73.6	78.3	42.5	33.9	100.0	100.0	57.0	100.0	100.0	100.0	100.0	96.5	100.0

Daily Average Rate of Consumption 1912.................... ▨

" " " Night " between 1 A.M. and 4 A.M. 1912.. ▦

Daily Average Rate of Consumption in 1911 shown in Red

amount remaining in the North Metropolitan Sewerage Loan Fund to construct the sewer, so that it will not be necessary to call for the issue of additional bonds for the North Metropolitan System.

The question has arisen several times in the past as to the advisability of increasing the amount which should be allowed to a city or town which furnishes a part of its water supply from its own works. The Board has considered that the time had arrived when some legislation should be adopted and accordingly has made the following recommendation: —

In considering the admission of other municipalities into the Metropolitan Water District the question has at different times in the past arisen whether, under proper circumstances, the sum which should be allowed cities and towns admitted into the District for furnishing water of proper quality from their own local sources should be increased. It is greatly for the advantage of the District and the Commonwealth that all the present satisfactory sources of water supply should be conserved and that these sources of supply should be made use of to a reasonable extent.

It would seem that when a municipality is admitted into the Metropolitan Water District, an inducement should, if practicable, be presented by which the city or town should continue to use its satisfactory sources of supply, provided that the terms for their use should be fair and equitable as they would affect the other municipalities in the District.

The Metropolitan Works have been built of much greater size and at a much greater cost than would otherwise have been the case, in order that an ample supply of water shall be assured even at times of extreme drought and in every exigency which can be anticipated, and the works must be maintained in readiness at all times to furnish the maximum quantity of water required to supply the whole district dependent upon them. If a city or town, upon coming into the District, proposes to take its water supply from its own sources so far as its works can furnish water, and to look to the Metropolitan Works to be helped out in periods of drought and when its own works prove inadequate to meet its requirements, the price of $12 per million gallons, now fixed by the statute, to be allowed for water furnished from local sources is quite large enough. The city or town would take and use the water only at times when its cost is the greatest to the District and avoid using it when the District has water in plenty to afford and perhaps going to waste.

If, however, a municipality will upon being admitted into the District agree to furnish from its own sources a constant, fixed quantity of water of proper quality for a term of years, it is the opinion of the Board that it will be for the interest of the District that a larger sum than $12 per million gallons shall be allowed on account of the water so furnished.

It is difficult to determine the sum which should be fairly allowed even under the conditions named. The value to the District of water so furnished from local sources would probably vary according to the circumstances in each case and be largely dependent upon the manner in which the water would be supplied. For instance, if a municipality were to supply water for its low service and to call upon the Metropolitan Works for its high service, the amount to be allowed would be decidedly less than if the city or town should supply its high service from its own sources leaving the low service to be supplied from Metropolitan sources.

The sum properly to be allowed would so depend on different conditions in each municipality that it does not seem practicable to name a certain fixed sum for allowance in every case.

It has seemed to the Board that inasmuch as the Metropolitan Water Act provides that any city or town within the ten-mile limit of the State House shall be admitted into the Metropolitan Water District upon the payment of such money as the Board shall determine, it would be wise to provide further that the Board may, within certain fixed limits, determine a sum per million gallons which shall be allowed to any such city or town on its admission, or to any city or town now belonging to the District, for such constant, fixed quantities of water as shall be furnished toward its supply from its own sources.

The Board, therefore, recommended to the Legislature for its consideration the passage of an act substantially as follows: —

Any city or town belonging to the Metropolitan Water District, established under the provisions of chapter 488 of the Acts of the year 1895, which is assessed upon its total valuation, or which shall be admitted to the District under said chapter or any subsequent act of the General Court, and which shall agree with the Metropolitan Water and Sewerage Board to furnish from its own works a constant, fixed quantity of water of proper quality for a term of five or more years, as a part of its own water supply, such quantity to be not greater than the safe capacity of its sources in a dry year as determined by said Board, shall be allowed and credited in its apportionment with such sum for each million gallons furnished in accordance with the agreement so made, as shall be determined in each year by the said Board and certified by it to the Treasurer of the Commonwealth, provided, however, that such sum shall not be less than twenty-four dollars per million gallons and shall not exceed the average cost to the Metropolitan Water District of water furnished from the said Metropolitan Water Supply during the year preceding that in which the assessment is made.

The Board considered it desirable to call attention in its preliminary report to two improvements connected with the harbor of Boston which had been authorized by the United States Congress. To carry out these improvements required, in the one case, a change in the Metropolitan water mains crossing Chelsea Creek, and, in the other case, a change in the North Metropolitan sewer crossing Malden River. The statement of the Board is as follows: —

During the past year the United States Congress has made appropriations for the performance by the Government of works of improvement connected with Boston Harbor, but requiring as conditions precedent to entering upon the works changes in the Metropolitan water pipes and sewers. Both of these matters would seem to call for legislation on the part of the Commonwealth by the present General Court.

The sum of $85,000 was appropriated by Congress for "improving the harbor at Boston, by dredging the channel of Chelsea creek" in accordance with the report of the Chief of Engineers and upon the conditions therein set forth. The report called for dredging the creek between East Boston and Chelsea so far as necessary to secure a channel depth of 25 feet and width of 150 feet, "conditioned, however, upon the lowering, without expense to the United States, of the 24-inch water main of the Metropolitan Water System, which crosses this stream about 800 feet above the Meridian Street bridge."

The recommendation for this improvement is made by the United States Engineering Department "in view of the large present commerce existing, in spite of many drawbacks, and of the great prospective increase of commerce" if such a channel be provided, and also in view of the general movement of the Commonwealth and of private owners in developing the commercial facilities of the harbor.

In order that the dredging may be carried to the required depth, it will be necessary to lower not only the 24-inch Metropolitan water main crossing the creek, which was laid in the year 1900 under the supervision and approval of the United States Government in place of a main previously laid by the city of Boston, but also a second 24-inch Metropolitan main laid many years ago by the city.

The lowering of these mains to the depth of 2 or 3 feet for a length of 150 feet in the middle of the channel, in literal compliance with the conditions to be fulfilled before the work can begin, would be at comparatively little expense, involving the expenditure of $5,000 or $6,000; but the actual distance between the pier head lines established on the East Boston and Chelsea sides of the creek is at the point of crossing about 400 feet. In order that the improvement may be made practically available, so that vessels may go up and down and be taken up to the piers and wharves on either side, as necessary for the deriving of any local advantage from the improvement, the mains will have to be lowered for the entire width of 400 feet.

To make the improvement of practical benefit would, therefore, as it appears, require the sinking of shafts one each side of the creek and the construction of a tunnel under the bed for the carrying of the water mains. The estimated expense of this work is $75,000.

Inasmuch as the mains were originally laid in accordance with the requirements, and the present changes are called for in the general scheme for the commercial development of the port, there seems to be no reason why the Metropolitan District should be called upon to defray the expense.

A conference has been had with the Directors of the Port of Boston and it was understood that they will recommend to the General Court the necessary legislation to provide for the lowering of the pipes as suggested, with the expectation that the necessary work will be performed under the direction of the Board but the expense will be met as the general charge of the Commonwealth.

The other appropriation of Congress was of the sum of $80,000 for improving Malden River in accordance with the report of the United States Engineers and subject to the conditions set forth therein.

One of the conditions precedent to the work is the lowering by the State of the Metropolitan sewer siphon now carried under the river. The circumstances attending this improvement are similar to those set forth in relation to the Chelsea Creek improvement.

It is proposed to dredge a channel in the middle of the river to a common depth of 6 feet at mean low water for a width of 100 feet. The entire distance between the lines of the dikes, which it is assumed will be erected and which will be the limit of private ownership on each side, will be, at the point of crossing, about 575 feet, and to make abutting lands available for the purposes for which the improvement is desired would require the lowering of the siphon for the entire width.

Here also in barely complying with the conditions, temporary work might be performed which in a short period would have to be replaced and extended at great additional expense.

The sewer crossing under the river at this point between the cities of Medford and Everett is by a masonry siphon. The cost of the work which would be required on account of the Government dredging for the width of 100 feet is estimated at $45,000, but to meet the purposes for which the improvement is demanded and to lower the masonry siphon for the entire width between the dikes the estimate is $90,000.

Other conditions imposed by Congress precedent to the undertaking of the work are that the riparian owners shall permit the dumping of material on their lands and shall execute releases to the area outside of the dike lines, and that the State shall pledge itself to maintain a new channel depth.

The improvement is recommended in the United States Engineers' Report upon the ground that it would "result in a large increase in commerce and would encourage the occupation of the adjoining land for manufacturing purposes."

As the lowering of the siphon is also called for, not on account of any question arising in regard to the Metropolitan Sewerage System, but for general commercial and manufacturing development, the expense attending it should not be imposed upon the North Metropolitan Sewerage District.

It is understood that the Directors of the Port will in this case also recommend the passage of the necessary legislation, the work to be performed by the Board but the expense of the work to be borne as the general charge of the Commonwealth.

XI. FUTURE WORK.

The maintenance and operation of the works for the water supply and its distribution to the cities and towns of the Metropolitan Water District will require under the estimates made for the current year the sum of $447,000. This sum is an increase of $21,000 over the estimate of last year, but a considerable portion of the increase will be offset by increased returns to the Commonwealth from the operations of the Board. The estimates submitted for the current year include the amounts required for the operation of the Wachusett power plant and for expenses to be incurred for the cutting of chestnut wood on account of the chestnut bark disease, but an increase is anticipated in the income from the operation of the Wachusett power plant, and a considerable further sum on account of chestnut wood and lumber which will be sold. The larger part, however, of the estimated increase is made in order to meet an expected increase required in the rate of wages of employés in the pumping stations, on the reservoirs, aqueducts and pipe lines and other operations of the Board.

The Board has asked authority to expend for the maintenance and operation of the Sewerage Works during the current year $170,600 for the North Metropolitan District and $109,460 for the South Metropolitan District. These sums are respectively $10,100 and $1,910 larger than the appropriations of last year. Though the steady increase from year to year in the amount of sewage to be disposed of requires a corresponding increase in quantities of coal and other supplies, the Sewerage estimates have also been more especially increased in order to meet an expected advance which will be required in the wages of pumping station and other employés.

It is expected that the Board will be able, by reason of the special sums which have been included in the maintenance appropriations of the last two years for the protection and improvement of the water supply, both in the Cochituate and Wachusett watersheds and along the Cochituate and Sudbury aqueducts, to enter upon efficient measures in pursuance of these purposes and that much work will be done in the coming year towards carrying out the projected improvements.

The larger work of new construction authorized by past legislation which will be carried on during the coming year is the laying of the new Mystic sewer in the Mystic valley from the city of Woburn through the town of Winchester and into the city of Medford, and the extension of the East Boston pumping station and installation of new screening machinery there, for which additional loans were provided to the amount of $378,000. Both these works will be vigorously prosecuted. It is also expected that the Board will be authorized to construct a short branch sewer in the city of Somerville for the relief of the city of Medford.

If the Legislature makes provision, as is anticipated, for carrying out the improvements authorized by the United States Congress for the development of the port of Boston by widening and deepening the channels of Chelsea Creek and Malden River, a considerable amount of construction work will be called for on the part of both the Water and Sewer departments.

Several cities and towns, some within and others without the limits laid down for the Metropolitan Water District, have been discussing the advisability of applying for admission into the District. Should one or more of the municipalities already eligible apply for admission, or should legislation be passed by which other municipalities should be received into the District, further new construction would be called for in order to make the necessary connections which would be required.

The detailed reports of the Chief Engineer of the Water Works and of the Engineer of the Sewerage Works, with various tables and statistics are herewith presented.

Respectfully submitted,

HENRY H. SPRAGUE,
HENRY P. WALCOTT,
JAMES A. BAILEY, Jr.,
Metropolitan Water and Sewerage Board.

Boston, February 26, 1913.

REPORT OF CHIEF ENGINEER OF WATER WORKS.

To the Metropolitan Water and Sewerage Board.

GENTLEMEN: — The following is a report of the work done under the charge of the Chief Engineer of the Metropolitan Water Works for the year ending December 31, 1912.

GENERAL STATEMENT.

The Chief Engineer has charge of the design and construction of all new works, and of the maintenance and operation of all the works controlled by the Metropolitan Water and Sewerage Board for supplying water to the eighteen municipalities which have received their supply from the Metropolitan Works.

ORGANIZATION.

The Chief Engineer has had the following assistants: —

William E. Foss,	Assistant to Chief Engineer.
Elliot R. B. Allardice,	Superintendent, Wachusett Department.
Charles E. Haberstroh,	Superintendent, Sudbury Department.
Samuel E. Killam,	Superintendent, Pipe Lines and Reservoirs, Distribution Department.
Arthur E. O'Neil,	Superintendent, Pumping Stations, Distribution Department.
Alfred O. Doane,	Division Engineer, specially in charge of engineering work at pumping stations.
Clifford Foss,	Assistant Engineer.
Benjamin F. Hancox,	Assistant in charge of Drafting Department.
James W. Killam,	Assistant Engineer, in charge of tests of coal and oil.
William E. Whittaker,	Office Assistant.
Arthur W. Walker,	Biologist, resigned September 24.
Charles E. Livermore,	Biologist, from September 24.
William W. Locke,	Sanitary Inspector.

At the beginning of the year the engineering force, including those engaged upon both the construction and maintenance of the works, numbered 46, and at the end of the year 42. The average force was constituted as follows: —

Chief Engineer,	1
Department Superintendents,	4
Division Engineers,	2
Assistant Engineers,	6
Assistant Engineer and Sanitary Inspector,	1
Draftsmen,	3
Instrumentmen,	6
Rodmen,	3
Inspector,	1
Office Assistant,	1
Biologists,	2
Sanitary Inspectors,	2
Stenographers and Clerks,	10
Photographer,	1
Messengers,	3
	46

There has been a maintenance force, exclusive of the engineers above mentioned, averaging 236, employed in the operation of the several pumping stations and in connection with the maintenance of the reservoirs, aqueducts and pipe lines, and in doing minor construction work.

The number of men employed in the maintenance force of the several departments has been as follows: —

	Beginning of Year.	End of Year.	Average.
Wachusett Department,	47	46	52
Sudbury Department,	44	44	51
Distribution Department, pipe lines and reservoirs,	68	71	76
Distribution Department, pumping service,	60	54	57
	219	215	236

In addition to the men employed in the regular maintenance force, a force averaging 43 men was employed from March 11 to September 14, under the supervision of Charles A. Haskin, in constructing an extension of the tunnel under Mystic River at Chelsea North Bridge, between Charlestown and Chelsea.

In addition to the men employed directly by the Board, a force averaging 10 men was employed from April 15 to the end of the year by the contractor for the Hyde Park Pumping Station.

CONSTRUCTION.

Hyde Park Pumping Station.

The land necessary for this station was acquired and the construction of the foundation for the building, chimney and engines commenced in 1911, the work being done by day-labor, under the supervision of the engineering department. Work was suspended for the winter on January 15, 1912, and was resumed on March 19. This force constructed the concrete foundation walls for the building, coal pocket, engines and boilers, the concrete floors in the coal pocket, boiler room and engine room basement, and laid all piping for water connections with the pumps and for drains in connection with the building and machinery.

A contract for constructing the superstructure of the pumping station was made with the A. Varnerin Company on March 28, 1912. The laying of the granite base was begun on May 20 and brick laying was commenced on May 24. In consequence of trouble experienced in obtaining terra cotta material of suitable color for the trimming of the building it was decided to use granite instead of terra cotta. This change delayed the construction of the outside walls in readiness to receive the roof until September 6. On October 7 the roof over both engine and boiler rooms was covered with roofing felt but not slated. The slating and copper work were completed on December 7, and at the close of the year work under this contract was finished with the exception of a small amount of painting and plumbing.

The building includes an engine room 60 feet long x 43 feet wide x 21.4 feet high from the floor to the roof plates, and a boiler room 38 feet long x 40 feet wide x 18.3 feet high from the floor to the roof plates, each surmounted by a hip roof supported by steel trusses and covered by hard pine sheathing and black slate. Under the engine room there is a basement 7.5 feet high and at the rear of the boiler room an underground coal pocket 39.5 feet long x 32 feet wide x 9 feet high, covered by a concrete roof, over which are carried the railroad side track and driveway. There are 16 openings in this roof, through which coal may be unloaded from cars or teams.

The external walls of the building are
trimmings of Deer Isle granite. The int
both engine and boiler rooms are of red
for the lower 5 feet in the engine room ha
The surface of the engine room floor, whi
tile, has not yet been laid. All other flo
granolithic surface. The brick chimney is
building, north of the boiler room. The po
the concrete foundation was built for the
W. W. Kellogg & Company of New York.
feet in exterior diameter at the base, dimi
6 feet below the top, and is surmounted by
is 2.5 feet in diameter. The chimney is pr
¼-inch copper rod connected with a 30-
copper plate buried in moist earth. A side
nected with the New York, New Haven
provide for the convenient delivery of coal

A contract for building and installing tw
station was made on September 18, 1911
Gordon Company of Cincinnati. The en
station on October 1, and their erection
October 20. It is expected that they will
a few weeks. They are of the horizontal
ing, fly-wheel type, each having a capa
States gallons in 24 hours when operated
feet per minute against a head of 140 fe
perform a duty of 115,000,000 foot pou
these conditions. Steam for operating the
by two externally fired, horizontal return
by the department force and built by the
pany, Ltd., of South Framingham. The
constructed by the Walter H. Preble Co
The grates were furnished by the New E
pany for $177.50. The steam and water
engines and boilers has been erected by
force connected with the pumping station
pocket is about 4 feet below that of the boi
elevator has been provided for raising the
boiler room floor. This elevator has bee

een the station, the dam and the ving are the statistics relating to

ut River Transmission

. . . . . .	5,716,595
ion (kilowatt hours), .	12,228
pumping station (kilo-	12,765
d (kilowatt hours), .	5,741,588
. . . . .	26,393,100,000
. . . . . .	90.8
foot gallons, . . .	2.396
. . . . . .	76.3

iver Trans- er thousand . . .	$30,297 95	
er Transmis- . . .	35 25	
erage pump- per thousand . . .	132 46	
		$30,465 66
. . .	$5,531 07	
. . .	85 76	
. . .	354 46	
. . .	87 11	
. . .	262 26	
. . .	2,675 00	
		8,995 66
. . . .		$21,470 00
ours generated, . . .		$3.74

LANEOUS.

Lexington has constructed a rein- in diameter and 105 feet high, with e high-water mark of this standpipe two standpipes previously used by the town, and it has substantially the same elevation as the Metropolitan Water Works standpipe in Arlington with which it is connected. The increased pressure was supplied to the town from the standpipe after October 28.

In April the old material which had been collected at different points on the works during the past 14 years was sold to J. F. Harrigan for the sum of $4,110. This material included two 5,000,000-gallon and one 8,000,000-gallon Worthington pumping engines; boilers, pumps, etc., formerly used by the city of Boston at the Mystic Pumping Station; hoisting engines and winches, centrifugal and plunger pumps, steam shovel and stone crusher, together with miscellaneous machinery and piping which had been used during the construction of the Wachusett and Sudbury works.

ENGINEERING.

In addition to the regular work in connection with the supervision of the maintenance and operation of the works the engineering force has supervised the work of extending the tunnel at the bridge between Chelsea and Charlestown, of lining the Sudbury Aqueduct at Echo Bridge, and of relaying pipes at the bridge over the Saugus River. Estimates have been made for lowering the pipes crossing Chelsea Creek between Chelsea and East Boston, and for relaying pipes across Charles River between Cambridge and Brighton, in connection with the reconstruction of the Stadium Bridge. Surveys and studies have been in progress for the construction of works to care for the manufacturing wastes and sewage from the town of Holden. Surveys and plan of Framingham Reservoir No. 1 have been completed, showing the property of the Commonwealth. The work of surveying and establishing property lines and setting stone bounds to mark the location of the property of the Board in Cedar Swamp, in Westborough, has been in progress. Surveys have been made of the properties formerly owned by the Chattanooga Mills, D. A. Burgess and D. W. Mitchell on the Sudbury River. Tables have been prepared giving the capacity of Lake Cochituate based upon recent surveys. An estimate was made of the cost of filtering the water of Lake Cochituate, this estimate having been presented to the Legislature in connection with the special report upon the subject made by this Board and the State Board of Health.

Appended to this report are tables giving the amount of work done and other information relative to contracts, a series of tables relating to the maintenance of the Metropolitan Water Works, including the rainfall, yield of sources of supply, consumption of water in the different districts, the number of service pipes, meters and fire hydrants in the Metropolitan Water District, and a summary of statistics for the year 1912.

Respectfully submitted,

DEXTER BRACKETT,
Chief Engineer.

BOSTON, January 1, 1913.

REPORT OF ENGINEER OF SEWERAGE WORKS.

To the Metropolitan Water and Sewerage Board.

GENTLEMEN: — The following report of the operations of the Metropolitan Sewerage Works for the year ending December 31, 1912, is respectfully submitted: —

ORGANIZATION.

The engineering organization until February 21, 1912, was as follows: —

Chief Engineer:
WILLIAM M. BROWN.

Division Engineers:

FREDERICK D. SMITH, .	*In charge of maintenance and construction, South Metropolitan System.*
FRANK I. CAPEN, . .	*In charge of maintenance and construction, North Metropolitan System.*
HENRY T. STIFF, . .	*In charge of office and drafting room.*

The resignations on February 21, 1912, of William M. Brown, Chief Engineer, to accept an important position elsewhere, and of Frank I. Capen, Division Engineer, on April 1, 1912, to enter private business, caused a reorganization of the engineering force.

On February 28, 1912, Frederick D. Smith was appointed Engineer in Charge of Sewerage Works.

The construction of the New Mystic Sewer through the town of Winchester and the city of Medford necessitated the employment of additional assistants who have been added as needed until the force at the end of the year consisted of the following: —

Division Engineer:

HENRY T. STIFF, . .	*In charge of office and drafting room and of construction of the New Mystic Sewer, North Metropolitan System.*

Assistant Engineers:

CLARENCE A. MOORE, .	*In charge of maintenance studies and records.*
ARTHUR F. F. HASKELL, .	*In charge of survey work and field work in connection with the New Mystic Sewer construction.*

In addition to the above, the average number of engineering and other assistants employed during the year was 12, which includes 1 instrumentman, 4 inspectors, 2 draftsmen, 3 rodmen and 2 stenographers.

METROPOLITAN SEWERAGE DISTRICTS.

Areas and Populations.

During the year no changes have been made in the extent of the sewerage districts as given in the last annual report.

The populations of the districts, as given in the following table, are based on the census of 1910.

Table showing Areas and Estimated Populations within the Metropolitan Sewerage Districts, as of December 31, 1912.

	City or Town.	Area (Square Miles).		Estimated Population.	
North Metropolitan District.	Arlington,	5.20		12,330	
	Belmont,	4.66		6,200	
	Boston (portions of),	3.45		106,380	
	Cambridge,	6.11		108,700	
	Chelsea,	2.24		35,260	
	Everett,	3.34		36,710	
	Lexington,[1]	5.11		4,280	
	Malden,	5.07		47,370	
	Medford,	8.35		25,270	
	Melrose,	3.73		16,490	
	Revere,	5.86		20,350	
	Somerville,	3.96		81,940	
	Stoneham,	5.50		7,720	
	Wakefield,	7.65		12,030	
	Winchester,	5.95		9,940	
	Winthrop,	1.61		11,240	
	Woburn,	12.71		15,930	
			90.50		558,140
South Metropolitan District.	Boston (portions of),[2]	24.96		213,200	
	Brookline,	6.81		30,010	
	Dedham,[1]	9.40		9,600	
	Milton,	12.59		8,380	
	Newton,	16.88		42,230	
	Quincy,	12.56		35,080	
	Waltham,	13.63		29,460	
	Watertown,	4.04		13,880	
			100.87		381,840
	Totals,		191.37		939,980

[1] Part of town.

[2] Including Hyde Park.

METROPOLITAN SEWERS.

Sewers Purchased and Constructed and their Connections.

During the year there has been built 0.09 of a mile of Metropolitan sewer within the sewerage districts, so that there are now 103.426 miles of Metropolitan sewers. Of this total, 9.642 miles of sewers, with the Quincy pumping station, have been purchased from cities and towns of the districts, the remaining 93.784 miles of Metropolitan sewers and other works having been constructed by the Metropolitan boards.

The locations, lengths and sizes of these sewers are given in Appendix No. 5, Table No. 1, together with other data referring to the public and special connections with the system.

Information relating to areas, populations, local sewer connections and other data for the whole Metropolitan Sewerage District appears in the following table: —

Area (Square Miles).	Estimated Total Population.	Miles of Local Sewer connected.	Estimated Population contributing Sewage.	Ratio of Contributing Population to Total Population (Per Cent.).	CONNECTIONS MADE WITH METROPOLITAN SEWERS.	
					Public.	Special.
North Metropolitan District.						
90.50	558,140	700.25	496,795	89.0	271	477
South Metropolitan District.						
100.87	381,840	572.40	252,265	66.1	130	33
Entire Metropolitan District.						
191.37	939,980	1,272.65	749,060	79.7	401	510

Of the estimated gross population of 939,980 on December 31, 1912, 749,060, representing 79.7 per cent, were on that date contributing sewage to the Metropolitan sewers, through a total length of 1,272.65 miles of local sewers owned by the individual cities and towns of the district.

These sewers are connected with the Metropolitan System by 401 public and 510 special connections. During the current year there has been an increase of 32.08 miles of local sewers connected with the Metropolitan System, and 7 public and 14 special connections have been added.

PUMPING STATIONS AND PUMPAGE.

The following table shows the average daily volume of sewage lifted at each of the six principal Metropolitan pumping stations and the Quincy sewage lifting station during the year, as compared with the corresponding volumes for the previous year.

PUMPING STATION.	AVERAGE DAILY PUMPAGE.			
	Jan. 1, 1911, to Dec. 31, 1911.	Jan. 1, 1912, to Dec. 31, 1912.	Increase during the Year.	
	Gallons.	Gallons.	Gallons.	Per Cent.
Deer Island,	52,800,000	55,700,000	2,900,000	5.5
East Boston,	50,800,000	53,700,000	2,900,000	5.7
Charlestown,	32,600,000	34,600,000	2,000,000	6.1
Alewife Brook,	3,012,000	3,446,000	434,000	14.4
Quincy,	4,069,000	3,958,000	111,000[1]	2.7[1]
Ward Street (actual gallons pumped),	22,600,000	26,258,000	3,658,000	16.2
Quincy sewage lifting station,	-	48,000	-	-

[1] Decrease.

CONSTRUCTION.

NORTH METROPOLITAN SYSTEM.

Chapter 461 of the Acts of 1912 provided for the construction of an additional Metropolitan sewer from a point in West Medford through the town of Winchester to the Woburn line, which has been designated the New Mystic Sewer.

The Act also provided for new screening facilities at the East Boston pumping station.

NEW MYSTIC SEWER.

Surveys and borings have been made and studies completed to determine the route of this sewer. A line through the central part of the town of Winchester was first studied in a preliminary way. In this line serious physical difficulties were encountered. Moreover, as the town of Winchester had purchased for park purposes the Whitney property and pond with the expectation of lowering the surface of the pond about five feet, it was found that it would be necessary to introduce three siphons if this line were followed, consequently the route has been laid east of the Aberjona River, largely through lands of the Boston & Maine Railroad, the Metropolitan Park Commission, the Winchester Park Commission and in public streets. By this route siphons are avoided and a good natural foundation for the sewer provided for most of its length.

The following are statistics relating to the operation of the pumping station: —

	Steam Plant from Jan. 1 to Oct. 28.	Electric Plant from Oct. 24 to Dec. 31.	Total.
Daily average quantity of sewage pumped (gallons), . .	1,120,000	783,000	1,057,000
Daily average quantity of coal consumed (pounds), . .	2,095	-	2,095
Daily average quantity of energy used (K. W. H.), . .	-	185	185
Number of days pumping, ...	297	69	366
Cost of pumping: —			
Labor, ...	$1,815 83	$336 22	$2,152 05
Fuel and electric energy (energy at $5.30 per thousand K. W. H.), ...	1,410 18	116 60	1,526 78
Repairs and supplies, ...	244 61	65 00	309 61
Total for station, ...	$3,470 62	$517 82	$3,988 44
Cost per million gallons pumped, ...	10 43	9 59	10 31
Cost per million gallons raised one foot high, . . .	0.212	0.197	0.209

A 12-inch single stage De Laval centrifugal pump, directly connected with a 40 H.P. motor of the General Electric squirrel cage type, has been installed at the pumping station and has been used since October 24 for pumping nearly all of the sewage received at the station. Energy for operating this plant is conveyed from the power plant at the Wachusett Dam to the sewerage pumping station, a distance of 2½ miles, by means of a 3-conductor No. 6 stranded, rubber-insulated, lead-covered cable carried under-ground for a distance of about 590 feet from the power station to Boylston Street, and for the remainder of the distance to the pumping station by three heavily insulated No. 6 copper wires attached to poles of the Worcester Consolidated Street Railway Company, the New England Telephone and Telegraph Company and the Clinton Gas Light Company on Boylston, Chestnut, Mechanic and High streets. At the power station there were installed three 25 K.V.A. transformers for transforming the energy from 13,800 volts to 2,300 volts, together with the necessary meters, switches and fuses for controlling and measuring the energy. At the pumping station there were placed a hand-operated starting compensator and a float switch for automatically stopping the motor. For recording and measuring the quantity of sewage pumped a Venturi meter was placed in the force main leading to the filter-beds.

The cost of the installation was divided approximately as follows: —

Transformer, meters and connections at power station,	$1,121 58
Transmission line,	3,652 52
Starting compensator, Venturi meter, piping, etc.,	1,886 19
Pump and motor,	965 00
Total,	$7,625 29

Filter-beds.

The sewage was applied to the filter-beds in practically the same manner as during the preceding four and one-half years. The beds were used in rotation throughout the year. Each of the 25 one-acre beds has received about 65,200 gallons of sewage in thirty minutes at intervals of two days. During the winter season the surface of the beds was plowed in furrows 3½ feet apart. The eight settling basins into which the sewage is pumped previous to being applied to the filter-beds were used in pairs in rotation throughout the year. During the winter season the basins were used continuously for a month, but from April 1 to December 1 the basins were emptied and cleaned after one week's use. The sludge collected in these basins, amounting to 732 cubic yards, has all been used on grass land on the back slope of the westerly portion of the North Dike. There has been a continuous improvement in the effluent from these beds during each year since 1909, when distributors and additional underdrains were constructed. The results obtained during the past year have been better than during any of the past thirteen years that the works have been operated.

The results of the analyses of the sewage and effluent are given in the following table: —

[Parts per 100,000.]

	Average of Four Years, 1906-09.	1910.	1911.	1912.		Whole Year, 1912.
				January to June.	July to December.	
Albuminoid ammonia, sewage,	.7540	.7050	1.0683	1.5900	1.6133	1.6017
Albuminoid ammonia, effluent,	.0768	.0686	.0639	.0981	.0466	.0724
Per cent. removed,	89.7	90.3	94	94	97	95
Oxygen consumed, sewage,	7.045	6.658	9.3292	11.258	12.367	11.812
Oxygen consumed, effluent,	1.085	.8863	.8713	.403	.631	.517
Per cent. removed,	83.5	86.7	91	96	95	95.5
Free ammonia, sewage,	4.1617	3.8867	5.7417	3.7067	5.0500	4.2129
Free ammonia, effluent,	1.3134	.6493	.7369	1.1348	.2071	.6710
Per cent. removed,	67.5	83.3	87	69	96	84
Nitrogen as nitrates, effluent,	.1724	.7338	.9740	.4411	1.2866	.8638
Iron, effluent,	1.9807	.6395	.5203	.6106	.1452	.3779

The cost of maintaining the filter-beds has been as follows: —

Labor,	$3,830 81
Supplies and expenses,	345 79
Total,	$4,176 60
Cost per million gallons treated,	$10 80

Hydro-electric Power Station.

The hydro-electric power station at the Wachusett Dam has been operated on 261 days during the year, and nearly all of the electric energy generated delivered to the Connecticut River Transmission Company under a 5-year contract which went into effect on October 2, 1911. Since October 15, 1912, a small quantity of energy has been used in operating a centrifugal pump for lifting the sewage at the Clinton sewerage pumping station. The daily output has varied from the minimum amount required under the contract to the full capacity of the plant. Under all conditions and combinations the plant has given excellent service, with only an occasional minor trouble, which has been immediately remedied.

The force employed includes one electrical engineer, one operator and two helpers who give all their time to the plant, and one helper whose time is divided equally between the station, the dam and the Superintendent's office. The following are the statistics relating to operations at this station: —

Quantity of energy sold to Connecticut River Transmission Company (kilowatt hours),	5,716,595
Quantity of energy used at power station (kilowatt hours),	12,228
Quantity of energy used at sewerage pumping station (kilowatt hours),	12,765
Total quantity of energy generated (kilowatt hours),	5,741,588
Quantity of water used (gallons),	26,393,100,000
Average effective head (feet),	90.8
Kilowatt hours generated per million foot gallons,	2.396
Efficiency of station (per cent.),	76.3

Earnings: —		
Energy supplied Connecticut River Transmission Company at $5.30 per thousand kilowatt hours,	$30,297 95	
Labor supplied Connecticut River Transmission Company,	35 25	
Energy supplied power and sewerage pumping stations, credited at $5.30 per thousand kilowatt hours,	132 46	
		$30,465 66
Cost of operating station: —		
Labor,	$5,531 07	
Fuel for heating building,	85 76	
Repairs and appliances,	354 46	
Oil and waste,	87 11	
Small supplies,	262 26	
Taxes,	2,675 00	
		8,995 66
Net earnings,		$21,470 00
Net earnings per thousand kilowatt hours generated,		$3.74

MISCELLANEOUS.

During the year the town of Lexington has constructed a reinforced concrete standpipe 30 feet in diameter and 105 feet high, with a capacity of 555,000 gallons. The high-water mark of this standpipe is 56 feet higher than that of the two standpipes previously used by the town, and it has substantially the same elevation as the Metropolitan Water Works standpipe in Arlington with which it is connected. The increased pressure was supplied to the town from the standpipe after October 28.

In April the old material which had been collected at different points on the works during the past 14 years was sold to J. F. Harrigan for the sum of $4,110. This material included two 5,000,000-gallon and one 8,000,000-gallon Worthington pumping engines; boilers, pumps, etc., formerly used by the city of Boston at the Mystic Pumping Station; hoisting engines and winches, centrifugal and plunger pumps, steam shovel and stone crusher, together with miscellaneous machinery and piping which had been used during the construction of the Wachusett and Sudbury works.

ENGINEERING.

In addition to the regular work in connection with the supervision of the maintenance and operation of the works the engineering force has supervised the work of extending the tunnel at the bridge between Chelsea and Charlestown, of lining the Sudbury Aqueduct at Echo Bridge, and of relaying pipes at the bridge over the Saugus River. Estimates have been made for lowering the pipes crossing Chelsea Creek between Chelsea and East Boston, and for relaying pipes across Charles River between Cambridge and Brighton, in connection with the reconstruction of the Stadium Bridge. Surveys and studies have been in progress for the construction of works to care for the manufacturing wastes and sewage from the town of Holden. Surveys and plan of Framingham Reservoir No. 1 have been completed, showing the property of the Commonwealth. The work of surveying and establishing property lines and setting stone bounds to mark the location of the property of the Board in Cedar Swamp, in Westborough, has been in progress. Surveys have been made of the properties formerly owned by the Chattanooga Mills, D. A. Burgess and D. W. Mitchell on the Sudbury River. Tables have been prepared giving the capacity of Lake Cochituate based upon recent surveys. An estimate was made of the cost of filtering the water of Lake Cochituate, this estimate having been presented to the Legislature in connection with the special report upon the subject made by this Board and the State Board of Health.

Appended to this report are tables giving the amount of work done and other information relative to contracts, a series of tables relating to the maintenance of the Metropolitan Water Works, including the rainfall, yield of sources of supply, consumption of water in the different districts, the number of service pipes, meters and fire hydrants in the Metropolitan Water District, and a summary of statistics for the year 1912.

Respectfully submitted,

DEXTER BRACKETT,
Chief Engineer.

BOSTON, January 1, 1913.

REPORT OF ENGINEER OF SEWERAGE WORKS.

To the Metropolitan Water and Sewerage Board.

GENTLEMEN: — The following report of the operations of the Metropolitan Sewerage Works for the year ending December 31, 1912, is respectfully submitted: —

ORGANIZATION.

The engineering organization until February 21, 1912, was as follows: —

Chief Engineer:
WILLIAM M. BROWN.

Division Engineers:

FREDERICK D. SMITH, .	*In charge of maintenance and construction, South Metropolitan System.*
FRANK I. CAPEN, . .	*In charge of maintenance and construction, North Metropolitan System.*
HENRY T. STIFF, . .	*In charge of office and drafting room.*

The resignations on February 21, 1912, of William M. Brown, Chief Engineer, to accept an important position elsewhere, and of Frank I. Capen, Division Engineer, on April 1, 1912, to enter private business, caused a reorganization of the engineering force.

On February 28, 1912, Frederick D. Smith was appointed Engineer in Charge of Sewerage Works.

The construction of the New Mystic Sewer through the town of Winchester and the city of Medford necessitated the employment of additional assistants who have been added as needed until the force at the end of the year consisted of the following: —

Division Engineer:

HENRY T. STIFF, . .	*In charge of office and drafting room and of construction of the New Mystic Sewer, North Metropolitan System.*

Assistant Engineers:

CLARENCE A. MOORE, .	*In charge of maintenance studies and records.*
ARTHUR F. F. HASKELL, .	*In charge of survey work and field work in connection with the New Mystic Sewer construction.*

In addition to the above, the average number of engineering and other assistants employed during the year was 12, which includes 1 instrumentman, 4 inspectors, 2 draftsmen, 3 rodmen and 2 stenographers.

METROPOLITAN SEWERAGE DISTRICTS.

Areas and Populations.

During the year no changes have been made in the extent of the sewerage districts as given in the last annual report.

The populations of the districts, as given in the following table, are based on the census of 1910.

Table showing Areas and Estimated Populations within the Metropolitan Sewerage Districts, as of December 31, 1912.

City or Town.		Area (Square Miles).		Estimated Population.	
North Metropolitan District.	Arlington,	5.20		12,330	
	Belmont,	4.66		6,200	
	Boston (portions of),	3.45		106,380	
	Cambridge,	6.11		108,700	
	Chelsea,	2.24		35,260	
	Everett,	3.34		36,710	
	Lexington,[1]	5.11		4,280	
	Malden,	5.07		47,370	
	Medford,	8.35		25,270	
	Melrose,	3.73		16,490	
	Revere,	5.86		20,350	
	Somerville,	3.96		81,940	
	Stoneham,	5.50		7,720	
	Wakefield,	7.65		12,030	
	Winchester,	5.95		9,940	
	Winthrop,	1.61		11,240	
	Woburn,	12.71		15,930	
			90.50		558,140
South Metropolitan District.	Boston (portions of),[2]	24.96		213,200	
	Brookline,	6.81		30,010	
	Dedham,[1]	9.40		9,600	
	Milton,	12.59		8,380	
	Newton,	16.88		42,230	
	Quincy,	12.56		35,080	
	Waltham,	13.63		29,460	
	Watertown,	4.04		13,880	
			100.87		381,840
Totals,			191.37		939,980

[1] Part of town.

[2] Including Hyde Park.

METROPOLITAN SEWERS.

Sewers Purchased and Constructed and their Connections.

During the year there has been built 0.09 of a mile of Metropolitan sewer within the sewerage districts, so that there are now 103.426 miles of Metropolitan sewers. Of this total, 9.642 miles of sewers, with the Quincy pumping station, have been purchased from cities and towns of the districts, the remaining 93.784 miles of Metropolitan sewers and other works having been constructed by the Metropolitan boards.

The locations, lengths and sizes of these sewers are given in Appendix No. 5, Table No. 1, together with other data referring to the public and special connections with the system.

Information relating to areas, populations, local sewer connections and other data for the whole Metropolitan Sewerage District appears in the following table: —

North Metropolitan District.

Area (Square Miles).	Estimated Total Population.	Miles of Local Sewer connected.	Estimated Population contributing Sewage.	Ratio of Contributing Population to Total Population (Per Cent.).	CONNECTIONS MADE WITH METROPOLITAN SEWERS.	
					Public.	Special.
90.50	558,140	700.25	496,795	89.0	271	477

South Metropolitan District.

100.87	381,840	572.40	252,265	66.1	130	33

Entire Metropolitan District.

191.37	939,980	1,272.65	749,060	79.7	401	510

Of the estimated gross population of 939,980 on December 31, 1912, 749,060, representing 79.7 per cent, were on that date contributing sewage to the Metropolitan sewers, through a total length of 1,272.65 miles of local sewers owned by the individual cities and towns of the district.

These sewers are connected with the Metropolitan System by 401 public and 510 special connections. During the current year there has been an increase of 32.08 miles of local sewers connected with the Metropolitan System, and 7 public and 14 special connections have been added.

PUMPING STATIONS AND PUMPAGE.

The following table shows the average daily volume of sewage lifted at each of the six principal Metropolitan pumping stations and the Quincy sewage lifting station during the year, as compared with the corresponding volumes for the previous year.

PUMPING STATION.	Average Daily Pumpage.			
	Jan. 1, 1911, to Dec. 31, 1911.	Jan. 1, 1912, to Dec. 31, 1912.	Increase during the Year.	
	Gallons.	Gallons.	Gallons.	Per Cent.
Deer Island,	52,800,000	55,700,000	2,900,000	5.5
East Boston,	50,800,000	53,700,000	2,900,000	5.7
Charlestown,	32,600,000	34,600,000	2,000,000	6.1
Alewife Brook,	3,012,000	3,446,000	434,000	14.4
Quincy,	4,069,000	3,958,000	111,000[1]	2.7[1]
Ward Street (actual gallons pumped),	22,600,000	26,258,000	3,658,000	16.2
Quincy sewage lifting station,	-	48,000	-	-

[1] Decrease.

CONSTRUCTION.

NORTH METROPOLITAN SYSTEM.

Chapter 461 of the Acts of 1912 provided for the construction of an additional Metropolitan sewer from a point in West Medford through the town of Winchester to the Woburn line, which has been designated the New Mystic Sewer.

The Act also provided for new screening facilities at the East Boston pumping station.

New Mystic Sewer.

Surveys and borings have been made and studies completed to determine the route of this sewer. A line through the central part of the town of Winchester was first studied in a preliminary way. In this line serious physical difficulties were encountered. Moreover, as the town of Winchester had purchased for park purposes the Whitney property and pond with the expectation of lowering the surface of the pond about five feet, it was found that it would be necessary to introduce three siphons if this line were followed, consequently the route has been laid east of the Aberjona River, largely through lands of the Boston & Maine Railroad, the Metropolitan Park Commission, the Winchester Park Commission and in public streets. By this route siphons are avoided and a good natural foundation for the sewer provided for most of its length.

SECTION 67. — NORTH METROPOLITAN SYSTEM.

This section starts from a point on the easterly side of the Boston & Maine Railroad at Station 56 + 80, Section 22 of the Metropolitan sewer constructed in 1893, at a distance of about 353 feet below the bellmouth at the intersection with the old Mystic Sewer, and extends through land of the Boston & Maine Railroad, including the old Mystic Sewer filtration beds, to and through land of C. F. and Robert Bacon, then through other land of said Railroad and through land of Robert Bacon and across Mystic Place to private land of Jacob W. Wilbur and through other land of Robert Bacon and along Grove Place.

This sewer is built partly in tunnel. Some particulars of the section are as follows: —

Total length of section, 4,800 feet.
Length of tunnel, 1,425 feet.
Average depth of cut in open trench, 21 feet.
Greatest depth in tunnel, 53 feet.
Diameter of concrete sewer (circular), 54 inches.
Name of contractor, Coleman Brothers.
Date of contract, October 15, 1912.
Division Engineer in charge of construction, Henry T. Stiff.
Assistant Engineer, A. F. F. Haskell.

At the present time work is in progress at two points in open trench and at five headings in tunnel. At the end of the year approximately twenty per cent. of the work was completed. The excavations in open cut are made with the assistance of a trench machine and a platform derrick which is used at the rock cut opening. Ground water was found at elevation 113 at Station 18 + 50 and is pumped by a 6-inch centrifugal pump. No excessive amount of ground water has been encountered. No ground water was found in the tunnel portion below Station 15. The earth material excavated so far has consisted of sand and gravel and some clay near the bottom. Excellent material for concrete has been found in abundance in the trench. This section will probably be completed about June 1, 1913.

Plans are in preparation for the remaining sections of this extension and contracts will be made for the same early in the coming year.

SCREENING MACHINERY AT EAST BOSTON PUMPING STATION.

The work of renewing and enlarging the screening plant at the East Boston pumping station, authorized by chapter 461 of the Acts of the year 1912, was commenced on July 23, 1912. On July 19, a taking of 1,725 square feet was made in Addison Street lying immediately east of the Boston & Albany Freight Railroad and south of the pumping station building. The screening at this station has been carried on in a small underground chamber which was built at the time of the construction of the original plant. The changes contemplate the abolition of this underground chamber and the screens will be operated from the ground level in a new building. The machinery will also be replaced in duplicate.

At the present time the concrete and brick masonry by-pass has been constructed, together with a new screen-chamber and the cast-iron screen guides are in place.

Suitable connection has been provided for an additional siphon across Chelsea Creek as was contemplated in the original plans.

A connection has been made between the sewer of the city of Boston in Addison Street and the suction sewer at the station. This connecting sewer has been furnished with a fixed screen to be used during the period of construction of the new work. When this work is completed the sewer will be relocated with a connection in such manner as to enter before the screens. The line of 6-inch water pipe which supplies the station has been changed to meet the new requirements.

ADDITION TO THE SCREEN-HOUSE BUILDING.

Plans have been prepared and contract made for the erection of the addition to the screen-house building. Following are the particulars of the contract:

Date of contract, December 26, 1912.
Name of contractor, J. E. Locatelli Company, Inc.
Price for reconstruction of screen-house building complete, $4,700.

At this date the contractor has brought some material but has done no construction work.

Plans have been made for the new screening machinery and a contract for the machinery will be made early in the coming year.

SIPHON AT SARATOGA STREET, EAST BOSTON.

In extending its drainage works the city of Boston found it necessary to cross with a siphon under the line of the Metropolitan sewer in Saratoga Street at a point near Station 2 + 60 of Section 9 of the North Metropolitan Sewer.

Because of the danger to the 9-foot Metropolitan main sewer during construction the city desired that this siphon should be constructed by the Metropolitan Water and Sewerage Board. Suitable arrangements were made whereby the city agreed to reimburse the Board for all expenses incurred, and work was begun on the siphon on September 4, 1912, under the supervision of Charles A. Haskin, using compressed air process. This siphon is built of brick and has a width of 5 feet and a height of 6 feet, and was successfully completed on October 30, 1912. Reimbursement from the city of Boston for all expenses was received by the Board.

MAINTENANCE.

SCOPE OF WORK AND FORCE EMPLOYED.

The maintenance of the Metropolitan Sewerage System includes the operation of 7 pumping stations, the Nut Island screen-house and 103.426 miles of Metropolitan sewers, receiving the discharge from 1,272.65 miles of city and town sewers at 401 points, together with the care and study of inverted siphons under streams and in the harbor.

The permanent maintenance force includes 170 men, of whom 103 are employed on the North System and 67 on the South System. These are subdivided as follows: North Metropolitan System, engineers and other employés at the pumping stations, 63, and on maintenance, care of sewer lines, buildings and grounds, 40 men; South Metropolitan System, 34 engineers and other employés within the pumping stations, and 33 men on maintenance, care of sewer lines, buildings and grounds.

In Appendix No. 5 will be found tables numbered 2 and 3 which contain data concerning the use of the system and its relation to the contributing cities and towns.

The regular work of this department, in addition to the operation of the pumping stations, has consisted of routine work of cleaning and inspecting sewers and siphons, care of pumping stations and other buildings and grounds, and the maintenance of the ferry at Shirley Gut for transporting employés and supplies in connection with the operation of the Deer Island pumping station.

In addition to these regular duties other work has been done by this department as below described.

Grade Crossing at Medford Street, Somerville, Fitchburg Division of the Boston & Maine Railroad.

At Medford Street, Somerville, the street has been depressed and the railroad carried across it on a bridge. The construction of the bridge abutments necessitated the driving of pile foundations and close attention had to be given to insure the safety of the Metropolitan sewer at this point. The inspection of this work in connection with the interests of the Metropolitan sewer has been done by a foreman and assistants of the maintenance department. No damage was done to the Metropolitan sewer.

During this construction it was necessary to make a temporary connection, without regulator, between the 4-foot local combined sewer in Medford Street and the Metropolitan sewer. This connection will be discontinued early in the coming year and the local sewage returned to its former channel.

Grade Crossing at Orient Heights, Boston, Revere Beach & Lynn Railroad.

At Saratoga Street, Orient Heights, the work of abolishing the grade crossing is in progress, the railroad being depressed 3 feet and the street raised 17 feet. It was found necessary to reinforce the 9-foot Metropolitan sewer at this point by constructing a relieving arch of steel reinforced concrete 12 inches thick at the crown over the sewer to support the railroad tracks and the street embankment of the approaches to the bridge. For a part of the distance it was necessary to carry this reinforcement on a pile foundation. The inspection of this work in connection with the interests of the Metropolitan sewer has been done by a foreman and assistants of the maintenance department.

At the end of the year 354 linear feet of arch reinforcement were completed, extending from Station 29 + 46 to Station 33, Section 8 of the North Metropolitan sewer, and the work of reinforcement will be continued when work opens in the spring. No damage has been done to the Metropolitan sewer.

BOILERS AND ECONOMIZER AT CHARLESTOWN STATION.

The Green economizer at the Charlestown station, which was installed at the time of the construction of the plant, had become so weakened by rust and deteriorated by formation of scale that it no longer gave trustworthy or economical service. Bids were invited from manufacturers and a Sturtevant economizer was purchased at a cost of $924.75, which included removing the old economizer and placing the new one in position, but did not include masonry changes. The maintenance department completed the masonry changes and made the necessary connections with the existing plant.

The horizontal tubular boilers at this station have been in use many years. Two were placed when the plant was installed in 1894 and two were added about five years later. The foundations of all of these had settled somewhat and the settings were rebuilt during the year. In connection with this the boiler inspector made a thorough examination of the boilers, subjecting them to a hydraulic pressure of 170 pounds and applying a hammer-test, so called. They were found to be in good condition.

New piping for feed and blow-off has been put in and the boiler plant generally put in first class condition. A new concrete floor will be placed in the boiler room early in the coming year.

DREDGING AT EAST BOSTON PUMPING STATION WHARF.

To facilitate the handling of cargoes of coal, it became necessary to dredge a berth alongside the wharf at the East Boston pumping station. A contract for this was entered into with the Bay State Dredging Company on April 6, 1912. The price for the complete dredging and removing of material was $375. This work was completed in May, 1912.

PAINTING.

During the year all the woodwork in buildings and on fences at the Nut Island station, dwelling house at Island Avenue, Quincy, Hough's Neck stock yard and at the Quincy pumping station was painted, and the brick buildings, together with the East Boston pumping station, received a coat of linseed oil outside. The concrete locker building at East Boston received two coats of "Cemcoat" paint. This work was done by the regular employés of the Board.

DRAINAGE FROM TANNERIES, GELATINE AND GLUE WORKS IN WINCHESTER, WOBURN AND STONEHAM.

Five men and a foreman have been employed during a part of the year in flushing and cleaning the Metropolitan sewer through the tannery districts of Winchester, Woburn and Stoneham.

All the tanneries and glue works of the district now have settling tanks of substantial size. This method of treatment has very greatly reduced the amount of sludge material entering the Metropolitan sewers and has materially lessened the cost of maintenance of the sewers in this district.

The following table gives details of settling tanks introduced to date, showing the operations of same with the amount of sludge collected and removed.

Table of Semi-fluid Sludge removed from Settling Basins at the Tanneries, Gelatine and Glue Works in Winchester, Woburn and Stoneham.

LOCATION OF BASIN.	Basin put in Operation.	Inside Measurement of Basin (Feet).	Number of Times cleaned during the Year 1912.	Average Quantity Semi-fluid Sludge removed (Cubic Yards).	Total Quantity Semi-fluid Sludge removed during the Year 1912 (Cubic Yards).
Beggs & Cobb Company, Basin No. 1, .	Jan. 15, 1910	47.0 × 23.0	7	131	918
Beggs & Cobb Company, Basin No. 2, .	May 9, 1910	47.0 × 23.0	11	116	1,275
Beggs & Cobb Company, Basin No. 3, .	Oct. 19, 1911	51.0 × 25.0	9	64.4	579
American Hide and Leather Company, Factory E.	Aug. 1, 1910	48.3 × 23.0	1	70	70
American Hide and Leather Company, Factory D.	Nov. 15, 1910	48.0 × 23.1	5½	133.5	734
Cottle Leather Company, ...	July 15, 1910	49.0 × 23.2	None	-	-
B. F. Kimball & Co., ...	Dec. 10, 1910	47.2 × 23.0	4½	140.5	632
E. Cummings Leather Company, . .	Nov. 1, 1910	45.9 × 22.6	7	102	716
W. P. Fox & Sons, ...	July 12, 1910	47.8 × 22.6	7	134	938
T. F. Boyle & Co., ...	Sept. 15, 1910	48.1 × 23.1	3	105	315
Champion Tanning Company, . . .	Jan. 9, 1911	46.8 × 22.9	4½	82	370
Stoneham Tanning Company, . . .	May 1, 1911	43.8 × 19.5	3½	142.5	499
American Glue Company, . . .	Oct. 1, 1910	47.1 × 23.0	3½	136.3	477
Winchester Manufacturing Company, .	1902	35.5 × 24.7 67.2 × 12.0	7	57.3	401
Total, ...	-	-	-	-	7,924

PUMPING STATIONS.

Capacity and Results.

Chapter 494, Acts of 1911, the eight-hour law, so called, became operative on July 1, 1911. At this date extra labor was employed at all of the pumping stations.

The cost of operation of the stations for the year ending December 31, 1911, was increased by the cost of this extra labor for one-half of the year. The cost for the year ending December 31, 1912, is increased over the previous year by the fact that this extra labor has been employed the whole year. The vacation period has also been increased from ten to fifteen days per year.

The following tables summarize the pumping records for the year for the Metropolitan sewerage stations: —

North Metropolitan System.

Deer Island Pumping Station.

At this station are four submerged centrifugal pumps with impellers or wheels 8.25 feet in diameter, driven by triple-expansion engines of the Reynolds-Corliss type.

Contract capacity of 1 pump: 100,000,000 gallons, with 19-foot lift.
Contract capacity of 3 pumps: 45,000,000 gallons each, with 19-foot lift.
Average duty for the year: 50,600,000 foot-pounds.
Average quantity raised each day: 55,700,000 gallons.
Force employed: 4 engineers, 1 relief engineer, 4 firemen, 3 oilers, 3 screenmen, 1 relief screenman and 1 laborer.
Coal used: New River, costing from $3.92 to $3.94 per gross ton.

Table of Approximate Quantities, Lifts and Duties at the Deer Island Pumping Station of the North Metropolitan System.

MONTHS.	Total Pumpage (Gallons).	Average per Day (Gallons).	Minimum Day (Gallons).	Maximum Day (Gallons).	Average Lift (Feet).	Average Duty (ft.-lbs. per 100 lbs. Coal).
1912.						
January,	2,116,300,000	68,300,000	58,500,000	100,300,000	11.45	58,200,000
February,	1,876,400,000	64,700,000	53,700,000	119,400,000	11.54	53,800,000
March,	2,047,500,000	66,000,000	49,900,000	108,300,000	11.06	53,800,000
April,	2,126,600,000	70,900,000	56,700,000	100,000,000	11.04	52,100,000
May,	1,959,300,000	63,200,000	50,100,000	78,400,000	10.90	53,300,000
June,	1,510,200,000	50,400,000	37,000,000	64,800,000	10.72	56,500,000
July,	1,643,800,000	53,000,000	39,000,000	82,800,000	10.54	50,300,000
August,	1,468,700,000	47,400,000	38,100,000	68,800,000	10.48	44,900,000
September,	1,336,200,000	44,500,000	34,200,000	65,100,000	10.81	45,800,000
October,	1,326,700,000	42,800,000	33,800,000	61,900,000	10.09	42,400,000
November,	1,387,600,000	46,300,000	39,000,000	71,900,000	10.53	46,400,000
December,	1,565,700,000	50,500,000	36,200,000	98,400,000	10.43	49,700,000
Total,	20,365,000,000	-	-	-	-	-
Average,	-	55,700,000	43,900,000	85,000,000	10.80	50,600,000

Average Cost per Million Foot-gallons for Pumping at the Deer Island Station.

Volume (20,365 Million Gallons) × Lift (10.80 Feet) = 219,942 Million Foot-gallons.

ITEMS.	Cost.	Cost per Million Foot-gallons.
Labor,	$13,487 60	$0.06132
Coal,	9,545 04	.04340
Oil,	371 20	.00169
Waste,	109 40	.00050
Water,	1,686 00	.00767
Packing,	117 55	.00053
Miscellaneous supplies and renewals,	1,377 75	.00626
Totals,	$26,694 54	$0.12137
Labor at screens,	-	.01304

East Boston Pumping Station.

At this station are four submerged centrifugal pumps, with impellers or wheels 8.25 feet in diameter, driven by triple-expansion engines of the Reynolds-Corliss type.

Contract capacity of 1 pump: 100,000,000 gallons with 19-foot lift.
Contract capacity of 3 pumps: 45,000,000 gallons each, with 19-foot lift.
Average duty for the year: 73,200,000 foot-pounds.
Average quantity raised each day: 53,700,000 gallons.
Force employed: 4 engineers, 2 relief engineers, 4 firemen, 1 relief fireman, 3 oilers, 3 screenmen, 1 relief screenman, 3 helpers and 1 laborer.
Coal used: New River, costing from $3.755 to $4 per gross ton.

Table of Approximate Quantities, Lifts and Duties at the East Boston Pumping Station of the North Metropolitan System.

MONTHS.	Total Pumpage (Gallons).	Average per Day (Gallons).	Minimum Day (Gallons).	Maximum Day (Gallons).	Average Lift (Feet).	Average Duty (ft.-lbs. per 100 lbs. Coal).
1912.						
January, ...	2,054,300,000	66,300,000	56,500,000	98,300,000	16.15	75,000,000
February, . . .	1,818,400,000	62,700,000	51,700,000	117,400,000	15.80	63,200,000
March, ...	1,985,500,000	64,000,000	47,900,000	106,300,000	15.83	64,000,000
April, ...	2,066,600,000	68,900,000	54,700,000	98,000,000	15.83	83,100,000
May, ...	1,897,300,000	61,200,000	48,100,000	76,400,000	15.66	80,800,000
June, ...	1,450,200,000	48,400,000	35,000,000	62,800,000	15.34	78,800,000
July, ...	1,581,800,000	51,000,000	37,000,000	80,400,000	14.76	73,800,000
August, ...	1,406,700,000	45,400,000	36,100,000	66,800,000	15.23	81,200,000
September, . . .	1,276,200,000	42,500,000	32,200,000	63,100,000	15.83	79,700,000
October, ...	1,264,700,000	40,800,000	31,800,000	59,900,000	15.47	76,800,000
November, . . .	1,327,700,000	44,300,000	37,000,000	69,900,000	15.39	65,100,000
December, . . .	1,503,700,000	48,500,000	34,200,000	96,400,000	15.13	56,900,000
Total, . . .	19,633,100,000	-	-	-	-	-
Average, . . .	-	53,700,000	41,900,000	83,000,000	15.54	73,200,000

Average Cost per Million Foot-gallons for Pumping at the East Boston Station.

Volume (19,633.1 Million Gallons) × Lift (15.54 Feet) = 305,098.4 Million Foot-gallons.

Items.	Cost.	Cost per Million Foot-gallons.
Labor,	$19,270 77	$0.06316
Coal,	9,952 86	.03262
Oil,	399 90	.00131
Waste,	138 65	.00046
Water,	1,695 60	.00556
Packing,	113 71	.00037
Miscellaneous supplies and renewals,	1,828 88	.00599
Totals,	$33,400 37	$0.10947
Labor at screens,	–	.00943

Charlestown Pumping Station.

At this station are three submerged centrifugal pumps, two of them having impellers or wheels, 7.5 feet in diameter, the other 8.25 feet in diameter. They are driven by triple-expansion engines of the Reynolds-Corliss type.

Contract capacity of 1 pump: 60,000,000 gallons with 8-foot lift.
Contract capacity of 2 pumps: 22,000,000 gallons each, with 11-foot lift.
Average duty for the year: 50,900,000 foot-pounds.
Average quantity raised each day: 34,600,000 gallons.
Force employed: 4 engineers, 1 relief engineer, 4 firemen, 3 oilers, 3 screenmen and 1 relief screenman.
Coal used: New River and Pocahontas, costing from $3.725 to $3.985 per gross ton.

Table of Approximate Quantities, Lifts and Duties at the Charlestown Pumping Station of the North Metropolitan System.

Months.	Total Pumpage (Gallons).	Average per Day (Gallons).	Minimum Day (Gallons).	Maximum Day (Gallons).	Average Lift (Feet).	Average Duty (ft.-lbs. per 100 lbs. Coal).
1912.						
January,	1,141,200,000	36,800,000	29,000,000	58,800,000	8.52	53,500,000
February,	1,097,500,000	37,800,000	30,300,000	63,500,000	8.48	50,400,000
March,	1,177,300,000	38,000,000	26,600,000	59,000,000	8.47	50,700,000
April,	1,200,600,000	40,000,000	32,400,000	50,800,000	8.66	58,000,000
May,	1,193,600,000	38,500,000	31,100,000	52,500,000	8.56	57,500,000
June,	996,600,000	33,200,000	27,400,000	37,400,000	8.24	49,300,000
July,	1,130,300,000	36,500,000	28,500,000	50,600,000	8.17	52,200,000
August,	973,700,000	31,400,000	27,400,000	38,500,000	8.03	49,700,000
September,	901,600,000	30,100,000	24,500,000	43,400,000	8.12	50,200,000
October,	940,700,000	30,300,000	24,500,000	43,100,000	8.08	46,300,000
November,	886,600,000	29,600,000	24,000,000	46,100,000	8.09	46,000,000
December,	1,031,300,000	33,300,000	25,000,000	59,300,000	8.27	46,700,000
Total,	12,671,000,000	-	-	-	-	-
Average,	-	34,600,000	27,600,000	50,300,000	8.31	50,900,000

Average Cost per Million Foot-gallons for Pumping at the Charlestown Station.

Volume (12,671 Million Gallons) × Lift (8.31 Feet) = 105,296 Million Foot-gallons.

Items.	Cost.	Cost per Million Foot-gallons.
Labor,	$12,743 77	$0.12103
Coal,	3,908 20	.03712
Oil,	225 02	.00214
Waste,	108 15	.00103
Water,	555 60	.00528
Packing,	41 68	.00039
Miscellaneous supplies and renewals,	700 51	.00665
Totals,	$18,282 93	$0.17364
Labor at screens,	-	.02781

Alewife Brook Pumping Station.

The plant at this station consists of the original installation of small commercial pumps and engines, *i.e.,* two 9-inch Andrews vertical centrifugal pumps, with direct-connected compound marine engines, together with the recent additions. The latter consists of a specially designed engine of the vertical cross-compound type, having between the cylinders a centrifugal pump rotating on a horizontal axis.

Contract capacity of the two original pumps: 4,500,000 gallons each, with 13-foot lift.
Contract capacity of new pump: 13,000,000 gallons, with 13-foot lift.
Average duty for the year: 17,400,000 foot-pounds.
Average quantity raised each day: 3,446,000 gallons.
Force employed: 3 engineers, 1 relief engineer, 3 screenmen and 1 relief screenman.
Coal used: New River, costing from $4.375 to $4.59 per gross ton.

Table of Approximate Quantities, Lifts and Duties at the Alewife Brook Pumping Station of the North Metropolitan System.

MONTHS.	Total Pumpage (Gallons).	Average per Day (Gallons).	Minimum Day (Gallons).	Maximum Day (Gallons).	Average Lift (Feet).	Average Duty (ft.-lbs. per 100 lbs. Coal).
1912.						
January,	137,237,000	4,427,000	3,862,000	6,695,000	12.62	19,000,000
February,	124,575,000	4,296,000	3,478,000	7,462,000	12.49	19,000,000
March,	154,161,000	4,973,000	3,669,000	6,872,000	12.54	21,900,000
April,	173,197,000	5,773,000	4,677,000	7,344,000	12.47	24,400,000
May,	131,866,000	4,254,000	3,574,000	5,300,000	12.44	19,200,000
June,	92,620,000	3,087,000	2,414,000	3,910,000	12.82	17,900,000
July,	88,130,000	2,843,000	2,288,000	4,318,000	12.67	16,700,000
August,	75,378,000	2,432,000	2,076,000	3,478,000	12.85	14,900,000
September,	64,106,000	2,137,000	1,868,000	3,380,000	12.87	13,700,000
October,	60,655,000	1,957,000	1,658,000	2,645,000	12.86	13,200,000
November,	69,280,000	2,309,000	1,826,000	3,526,000	12.84	13,700,000
December,	88,786,000	2,864,000	2,120,000	5,429,000	12.87	16,300,000
Total,	1,259,991,000	-	-	-	-	-
Average,	-	3,446,000	2,793,000	5,028,000	12.70	17,400,000

Average Cost per Million Foot-gallons for Pumping at the Alewife Brook Station.

Volume (1,259.991 Million Gallons) × Lift (12.70 Feet) = 16,001.9 Million Foot-gallons.

ITEMS.	Cost.	Cost per Million Foot-gallons.
Labor,	$6,385 78	$0.39906
Coal,	1,611 65	.10071
Oil,	138 35	.00865
Waste,	77 93	.00487
Water,	211 32	.01321
Packing,	4 30	.00027
Miscellaneous supplies and renewals,	296 52	.01853
Totals,	$8,725 85	$0.54530
Labor at screens, oiling and miscellaneous services,	-	.11702

SOUTH METROPOLITAN SYSTEM.

Ward Street Pumping Station.

At this station are two vertical, triple-expansion pumping engines, of the Allis-Chalmers type, operating reciprocating pumps, the plungers of which are 48 inches in diameter with a 60-inch stroke.

Contract capacity of 2 pumps: 50,000,000 gallons each, with 45-foot lift.
Average duty for the year: 81,075,000 foot-pounds.
Average quantity raised each day: 26,258,000 gallons.
Force employed: 4 engineers, 1 relief engineer, 4 firemen, 4 oilers, 4 assistant engineers, 1 machinist and 1 laborer.
Coal used: New River, costing from $3.91 to $4.35 per gross ton.
Material intercepted at screens during the year, 1,206 cubic yards.

Table of Approximate Quantities, Lifts and Duties at the Ward Street Pumping Station of the South Metropolitan System.

MONTHS.	Total Pumpage (Gallons).	Average per Day (Gallons).	Minimum Day (Gallons).	Maximum Day (Gallons).	Average Lift (Feet).	Average Duty (ft.-lbs. per 100 lbs. Coal).
1912.						
January,	910,129,000	29,359,000	26,029,000	36,379,000	41.17	87,800,000
February,	845,440,000	29,134,000	22,600,000	54,315,000	40.78	85,000,000
March,	1,026,523,000	33,099,000	23,250,000	47,787,000	41.50	91,700,000
April,	1,095,814,000	36,527,000	30,600,000	45,000,000	42.56	92,500,000
May,	934,875,000	30,158,000	18,250,000	36,500,000	40.96	86,000,000
June,	732,244,000	24,408,000	19,100,000	29,100,000	40.27	83,800,000
July,	736,999,000	23,771,000	17,800,000	44,700,000	40.17	85,500,000
August,	692,126,000	23,327,000	19,670,000	26,350,000	39.35	79,500,000
September,	606,389,000	20,213,000	15,550,000	27,450,000	39.18	70,800,000
October,	662,216,000	21,362,000	17,669,000	27,255,000	39.30	72,200,000
November,	642,953,000	21,432,000	17,600,000	30,390,000	39.40	72,200,000
December,	691,471,000	22,305,000	17,000,000	35,400,000	39.50	65,900,000
Total,	9,577,179,000	-	-	-	-	-
Average,	-	26,258,000	20,427,000	36,719,000	40.35	81,075,000

Records from plunger displacement.

Average Cost per Million Foot-gallons for Pumping at the Ward Street Station.

Volume (9,577.1 Million Gallons) × Lift (40.35 Feet) = 386,436 Million Foot-gallons.

ITEMS.	Cost.	Cost per Million Foot-gallons.
Labor,	$16,166 12	$0.04183
Coal,	8,426 68	.02180
Oil,	232 24	.00060
Waste,	31 70	.00008
Water,	1,534 80	.00397
Packing,	181 31	.00047
Miscellaneous supplies and renewals,	2,201 22	.00570
Totals,	$28,774 07	$0.07445
Labor at screens,	-	.01164

Quincy Pumping Station.

At this station are two compound condensing Deane pumping engines and one Lawrence centrifugal pump driven by a Sturtevant compound condensing engine.

Contract capacity of 3 pumps: Deane, 3,000,000 gallons; Deane, 5,000,000 gallons; Lawrence centrifugal, 10,000,000 gallons.

Average duty for the year: 31,375,000 foot-pounds.

Average quantity raised each day: 3,958,000 gallons.

Force employed: 3 engineers, 1 relief engineer, 3 screenmen and 1 relief screenman.

Coal used: New River, costing from $4.505 to $4.69 per gross ton.

Materials intercepted at screen during the year, 194 cubic yards.

Table of Approximate Quantities, Lifts and Duties at the Quincy Pumping Station of the South Metropolitan System.

MONTHS.	Total Pumpage (Gallons).	Average per Day (Gallons).	Minimum Day (Gallons).	Maximum Day (Gallons).	Average Lift (Feet).	Average Duty (ft.-lbs. per 100 lbs. Coal).
1912.						
January,	165,185,000	5,329,000	4,510,000	9,170,000	22.01	35,500,000
February,	136,989,000	4,724,000	3,745,000	8,014,000	21.75	32,300,000
March,	165,202,000	5,329,000	3,931,000	7,175,000	23.19	34,800,000
April,	178,243,000	5,941,000	5,071,000	7,095,000	25.50	36,400,000
May,	155,999,000	5,032,000	4,355,000	5,628,000	22.16	34,700,000
June,	116,485,000	3,883,000	3,154,000	4,503,000	21.17	32,500,000
July,	102,932,000	3,320,000	2,950,000	3,706,000	21.02	31,400,000
August,	90,565,000	2,921,000	2,551,000	3,200,000	21.03	30,000,000
September,	80,980,000	2,699,000	2,389,000	2,947,000	21.07	28,000,000
October,	79,070,000	2,551,000	2,227,000	2,817,000	21.01	26,300,000
November,	81,544,000	2,718,000	2,460,000	3,098,000	21.01	27,200,000
December,	94,397,000	3,046,000	2,586,000	5,113,000	21.07	27,400,000
Total,	1,447,591,000	-	-	-	-	-
Average,	-	3,958,000	3,327,000	5,206,000	21.83	31,375,000

Average Cost per Million Foot-gallons for Pumping at the Quincy Station.

Volume (1,447.6 Million Gallons) × Lift (21.83 Feet) = 31,601.1 Million Foot-gallons.

ITEMS.	Cost.	Cost per Million Foot-gallons.
Labor,	$6,331 95	$0.20037
Coal,	1,678 39	.05311
Oil,	38 90	.00123
Waste,	18 20	.00057
Water,	227 69	.00720
Packing,	33 16	.00105
Miscellaneous supplies and renewals,	441 03	.01395
Totals,	$8,769 32	$0.27748
Labor at screens, oiling and miscellaneous services,	-	.05063

Nut Island Screen-House.

The plant at this house includes two sets of screens in duplicate, actuated by small reversing engines of the Fitchburg type. Two vertical Deane boilers, 80 horse-power each, operate the engines, provide heat and light for the house, burn materials intercepted at the screens, and furnish power for the Quincy sewage lifting station.

Average daily quantity of sewage passing screens, 48,200,000 gallons.
Total materials intercepted at screens, 1,145.5 cubic yards.
Materials intercepted per million gallons of sewage discharged, 1.75 cubic feet.
Force employed: 3 engineers, 1 relief engineer, 3 screenmen and 1 relief screenman.
Coal used: New River, costing from $4.04 to $4.12 per gross ton.

Quincy Sewage Lifting Station.

At this station are two 6-inch submerged Lawrence centrifugal pumps with vertical shafts actuated by two Sturtevant direct-current motors.

The labor and electric energy for this station are supplied from the Nut Island screen-house and as used at present it does not materially increase the amount of coal used at the latter station. The effluent is largely ground water.

Average daily amount pumped, 48,000 gallons.
Average lift, 15.8 feet.

Coal for use at the several stations has been purchased as follows: —

	Gross Tons, Bituminous Coal.							
	Deer Island Pumping Station.	East Boston Pumping Station.	Charlestown Pumping Station.	Alewife Brook Pumping Station.	Ward Street Pumping Station.	Quincy Pumping Station.	Nut Island Screen-house.	Price per Gross Ton.[1]
Metropolitan Coal Company, .	696.496	-	-	-	-	-	-	$3 92
Staples Coal Company, . .	420.000	-	-	-	-	-	-	3 93
Metropolitan Coal Company, .	221.310	-	-	-	-	-	-	3 94
Staples Coal Company, . .	929.550	-	-	-	-	-	-	3 94
New England Coal and Coke Company.	-	312.460	-	-	-	-	-	3 755
New England Coal and Coke Company.	-	716.905	-	-	-	-	-	3 78
New England Coal and Coke Company.	-	147.362	-	-	-	-	-	3 815
Metropolitan Coal Company, .	-	216.000	-	-	-	-	-	3 84
Metropolitan Coal Company, .	-	117.244	-	-	-	-	-	3 91
Metropolitan Coal Company, .	-	244.750	-	-	-	-	-	3 94
Metropolitan Coal Company, .	-	588.100	-	-	-	-	-	3 985
Metropolitan Coal Company, .	-	338.829	-	-	-	-	-	4 00
New England Coal and Coke Company.	-	-	37.231	-	-	-	-	3 725
New England Coal and Coke Company.	-	-	242.471	-	-	-	-	3 75
New England Coal and Coke Company.	-	-	284.100	-	-	-	-	3 765
Metropolitan Coal Company, .	-	-	291.630	-	-	-	-	3 92
Metropolitan Coal Company, .	-	-	461.000	-	-	-	-	3 985
New England Coal and Coke Company.	-	-	-	115.137	-	-	-	4 375
New England Coal and Coke Company.	-	-	-	92.848	-	-	-	4 40
Locke Coal Company, . .	-	-	-	29.060	-	-	-	4 54
Locke Coal Company, . .	-	-	-	89.150	-	-	-	4 59
Staples Coal Company, . .	-	-	-	-	424.965	-	-	3 91
Staples Coal Company, . .	-	-	-	-	223.521	-	-	3 97
Staples Coal Company, . .	-	-	-	-	456.092	-	-	4 005
Metropolitan Coal Company, .	-	-	-	-	891.153	-	-	4 315
Metropolitan Coal Company, .	-	-	-	-	102.070	-	-	4 35
City Fuel Company, . . .	-	-	-	-	-	164.495	-	4 505
Neponset Coal Company, . .	-	-	-	-	-	108.389	-	4 53
City Fuel Company, . . .	-	-	-	-	-	61.600	-	4 65
City Fuel Company, . . .	-	-	-	-	-	53.910	-	4 69
Staples Coal Company, . .	-	-	-	-	-	-	100	4 04
Metropolitan Coal Company, .	-	-	-	-	-	-	400	4 12
Total gross tons, . . .	2,267.356	2,681.650	1,316.432	326.195	2,097.801	388.394	500	-
Average price per gross ton, .	$3 93	$3 876	$3 87	$4 455	$4 13	$4 56	$4 10	-

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[1] Include adjustments for quality.

METROPOLITAN SEWERAGE OUTFALLS.

The Deer Island outfall has been in continuous operation since May, 1895.

The 60-inch outfall pipes on the South Metropolitan System have been in operation since October, 1904.

These outfalls are in good condition and free from deposit. During the year the average flow through the North Metropolitan outfall at Deer Island has been 55,700,000 gallons of sewage per 24 hours, with a maximum rate of 151,800,000 gallons on December 27. The average discharge from the outfalls of the South Metropolitan System during the year has been 48,200,000 gallons of sewage per 24 hours, with a maximum rate of 135,000,000 gallons per 24 hours on February 21.

Material Intercepted at the Screens.

The material intercepted at the screens at the North Metropolitan Sewerage stations, consisting of rags, paper and other floating materials, has during the year amounted to 4,069 cubic yards. This is equivalent to 5.4 cubic feet for each million gallons of sewage pumped at Deer Island.

The material intercepted at the screens at the South Metropolitan Sewerage stations has amounted to 2,545.5 cubic yards, equal to 3.89 cubic feet per million gallons of sewage delivered at outfall works at Nut Island.

Studies of sewage flows indicate that the Metropolitan sewers and siphons are free from deposit.

I wish to express my appreciation of the value of the services rendered to me by the assistants in their various capacities.

FREDERICK D. SMITH,
Engineer of Sewerage Works.

BOSTON, January 1, 1913.

APPENDIX.

APPENDIX No. 1.

CONTRACTS MADE AND PENDING DURING

[NOTE. — The details of contracts made before

	1. Number of Contract.	2. WORK.	3. Number of Bids.	AMOUNT OF BID. 4. Next to Lowest.	AMOUNT OF BID. 5. Lowest.	6. Contractor.
1	312	40-million-gallon pumping engine.	4	$105,700 00	$99,769 00[1]	Holly Mfg. Co., Buffalo, N. Y.
2	340[2]	30 water valves; 4 24-inch, 8 20-inch, 12 16-inch, 6 12-inch valves.	3	6,434 00	5,000 00[1]	Pratt & Cady Co., Hartford, Conn.
3	346	2 3-million-gallon pumping engines for Southern Extra High Service Pumping Station.	Engine No. 1, 5.	7,886 00	7,525 00[1]	Laidlaw-Dunn-Gordon Co., Cincinnati, O.
			Engine No.2, 7.	8,825 00[1]	8,738 00	
4	347	Southern Extra High Service Pumping Station.	10	21,148 00	19,984 00[1]	A. Varnerin Co., Boston.
5	348[2]	160 tons cast-iron water pipe: 25 tons 24-inch pipe with flexible joints; 20 tons 30-inch straight pipe; 85 tons 24-inch straight pipe; 20 tons 12-inch straight pipe and 10 tons 6-inch straight pipe; and 15 tons special castings.	3	4,753 00	4,672 50[1]	Warren Foundry and Machine Co., Phillipsburg, N. J.
6	349[2]	2 horizontal fire-tube boilers for Southern Extra High Service Pumping Station.	4	1,685 00	1,671 00[1]	Robb Engineering Co., Ltd., Boston.
7	350	Furnishing and placing about 1,200 cubic yards of loam at Southern Extra High Service Pumping Station.	1	-	$1.30[1] per cu. yd.	T. H. Corrigan, Boston.
8	23-M[2]	1,050 tons New River or Pocahontas coal: 350 tons for Arlington Pumping Station, 700 tons for Spot Pond Pumping Station.	4[3] 3[4]	$3.88 and $4.68, July to Apr., $4.78, Apr. to July.	$3.80[1] and $4.35[1] ton.	New England Coal and Coke Co., Boston.
9	24-M[2]	5,500 tons Beaver Run coal for Chestnut Hill Pumping Stations.	10	$3.79[1] per ton.	$3.75 per ton.	Gorman-Leonard Coal Co., Worcester.

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[1] Contract based upon this bid.

[2] Contract completed.

APPENDIX NO. 1.

THE YEAR 1912 — WATER WORKS.

1912 have been given in previous reports.]

7. Date of Contract.	8. Date of Completion of Work.	9. Prices of Principal Items of Contracts made in 1912.	10. Value of Work done Dec. 31, 1912.	
Sept. 21, 1909	-	- -	$99,500 00	1
June 3, 1911	Apr. 15, 1912	- -	5,000 00	2
Sept. 18, 1911	-	- -	15,000 00	3
Mar. 28, 1912	-	For pumping station superstructure complete with all appurtenances, $19,984.	20,500 00	4
Apr. 4, 1912	July 26, 1912	For 24-inch pipe with flexible joints, $30 per ton of 2,000 pounds; for all straight pipe, $23.50 per ton of 2,000 pounds; for special castings, $50 per ton of 2,000 pounds.	4,763 28	5
Apr. 27, 1912	Sept. 4, 1912	For whole work, $1,671, ...	1,711 00	6
Dec. 30, 1912	-	For furnishing and placing loam, $1.30 per cubic yard.	-	7
July 8, 1911	May 17, 1912	- -	4,474 28	8
Oct. 24, 1911	July 13, 1912	- -	17,768 77	9

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[3] Arlington Station.

[4] Spot Pond Station.

CONTRACTS MADE AND PENDING DURING

	1.	2.	3.	AMOUNT OF BID.		6.
	Number of Contract.	WORK.	Number of Bids.	4. Next to Lowest.	5. Lowest.	Contractor.
10	25-M	Electric motor and centrifugal pump for Clinton Sewerage Pumping Station.	6	$786 00	$965 00[1,5]	Power Equipment Co., Boston.
11	26-M	450 tons B. C. C. Miller vein coal for Arlington Pumping Station.	2	$4.30 per ton.	$4.24[1] per ton.	Bader Coal Co., Boston.
12	27-M	1,000 tons Georges Creek Cumberland coal for Spot Pond Pumping Station.	2	$5.05 per ton.	$4.80[1] per ton.	Locke Coal Co., Malden.
13	28-M	7,000 tons Sonman coal for Chestnut Hill Pumping Stations.	8	$3.80 per ton.	$3.79[1] per ton.	Gorman-Leonard Coal Co., Worcester.
14	29-M[2]	Dredging, pile driving, etc., connected with lowering of 20-inch siphon across Saugus River at Fox Hill Bridge.	3	$1,300 00	$1,100 00[1]	The Snaire & Triest Co., New York, N.Y.
15	30-M[2]	Repairing roof of Lower Gate Chamber at Wachusett Dam.	–[6]	-	-	W. P. Leavitt Sons Co., Newton.
16	Special[2] Order.	6 sets steelwork for chambers for 36-inch valves.	3	390 00	240 00[1]	James Russell Boiler Works Co., Boston.
17	Special[2] Order.	Installing transmission line from Wachusett Dam to Sewerage Pumping Station, Clinton.	–[7]	-	-	Light, Heat and Power Corporation, Boston.
18	Special Order.	Furnishing and erecting ferrolithic plate, plastering and concrete floor of lavatory and locker room at Chestnut Hill Pumping Station.	3	693 00	540 00[1]	Robert Gallagher Co., Boston.
19	Special Order.	Plumbing in lavatory and locker room at Chestnut Hill Pumping Station.	3	375 00	340 00[1]	H. W. Orr Co., Newtonville.
20	Special[2] Order.	Building brick settings for two horizontal tubular boilers at Southern Extra High Service Pumping Station.	2	960 00	850 00[1]	Walter H. Preble Co., Boston.
21	Special[2] Order.	Building and installing hydraulic coal elevator at Southern Extra High Service Pumping Station.	4	550 00	490 00[1]	F. S. Payne Co., Cambridge.
22	Special[2] Order.	Furnishing steam piping, fittings and valves at Southern Extra High Service Pumping Station.	4	306 00	302 67[1]	Wm. H. Gallison Co., Boston.

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[1] Contract based upon this bid.

[2] Contract completed.

THE YEAR 1912 — WATER WORKS — *Continued.*

7. Date of Contract.	8. Date of Completion of Work.	9. Prices of Principal Items of Contracts made in 1912.	10. Value of Work done Dec. 31, 1912.	
May 31, 1912	-	For whole work, $965, ...	$965 00	10
June 3, 1912	-	$4.24 per ton of 2,240 pounds delivered on cars at the Arlington Station.	1,282 36	11
June 5, 1912	-	$4.80 per ton of 2,240 pounds delivered in bins at the Spot Pond Station.	3,323 60	12
June 3, 1912	-	$3.79 per ton of 2,240 pounds delivered on cars at Chestnut Hill Pumping Stations.	12,294 89	13
June 27, 1912	Aug. 12, 1912	For furnishing necessary labor and plant to do all dredging required, $1,100.	1,460 99	14
Oct. 11, 1912	Dec. 2, 1912	For whole work, $1,100, ...	1,100 00	15
Aug. 14, 1912	Oct. 10, 1912	For each set, $40, ...	240 00	16
Aug. 19, 1912	Oct. 30, 1912	Cost of materials and labor plus 10 per cent., .	2,704 53	17
Oct. 9, 1912	-	For whole work, $540, ...	-	18
Oct. 9, 1912	-	For whole work, $340, ...	-	19
Oct. 14, 1912	Nov. 6, 1912	For whole work, $850, ...	850 00	20
Oct. 25, 1912	Dec. 21, 1912	For whole work, $490, ...	490 00	21
Nov. 5, 1912	Dec. 13, 1912	For whole work, $302.67, ...	302 67	22
			$193,731 37	

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[5] Efficiency considered, this was lowest bid.

[6] Competitive bids were not received.

[7] Competitive bids were received for materials only.

CONTRACTS MADE AND PENDING DURING THE YEAR 1912 — WATER WORKS — *Concluded.*

Summary of Contracts.[1]

	Value of Work done Dec. 31, 1912.
Distribution Department, 7 contracts,	$146,474 28
338 contracts completed from 1896 to 1911, inclusive,	16,709,921 80
	$16,856,396 08
Deduct for work done on 11 Sudbury Reservoir contracts by the city of Boston,	512,000 00
Total of 356 contracts,	$16,344,396 08

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[1] In this summary contracts charged to maintenance are excluded.

APPENDIX NO. 2.

TABLE NO. 1. — *Monthly Rainfall in Inches at Various Places on the Metropolitan Water Works, in 1912.*

Place.		January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.
Wachusett Watershed.	Princeton,	2.46	2.18	5.52	3.92	5.94	0.70	2.56	3.34	2.39	3.00	3.83	5.10	40.94
	Jefferson,	2.72	2.52	5.66	4.37	5.14	0.52	2.77	2.48	2.49	2.18	4.19	5.24	40.28
	Sterling,	2.20	2.28	5.63	3.69	6.15	0.36	2.43	2.82	1.98	2.41	3.96	4.69	38.60
	Boylston,	2.90	2.72	5.94	4.26	5.81	0.33	2.84	2.92	1.81	2.52	4.11	4.79	40.95
Sudbury Watershed.	Sudbury Dam,	2.77	2.88	6.04	4.19	4.71	0.28	2.64	3.24	1.80	2.01	3.58	4.94	39.08
	Framingham,	2.84	2.64	6.33	4.12	4.20	0.38	3.35	2.92	1.70	2.58	3.54	5.02	39.62
	Ashland Dam,	2.99	2.64	6.66	4.27	4.65	0.49	3.84	2.64	1.56	2.32	3.32	4.99	40.37
	Cordaville,	3.18	2.91	6.82	4.89	4.64	0.67	3.13	3.40	1.98	2.50	4.11	5.56	43.79
Lake Cochituate,		3.10	2.51	6.38	4.16	5.23	0.47	3.00	2.26	1.82	2.99	3.24	4.96	40.12
Chestnut Hill Reservoir,		3.64	2.48	5.36	3.92	4.06	0.34	6.39	2.24	1.72	1.61	3.00	5.20	39.96
Spot Pond,		3.13	2.50	4.98	3.71	5.10	0.35	5.27	2.13	2.58	1.69	2.94	4.89	39.27
Average of all,		2.90	2.57	5.94	4.14	5.06	0.44	3.47	2.76	1.99	2.35	3.62	5.03	40.27
Average, Wachusett watershed,		2.57	2.42	5.69	4.06	5.76	0.48	2.65	2.89	2.17	2.53	4.02	4.95	40.19
Average, Sudbury watershed,		2.94	2.77	6.46	4.37	4.55	0.46	3.24	3.05	1.76	2.35	3.64	5.13	40.72

TABLE No. 2. — *Rainfall in Inches at Jefferson, Mass., in 1912.*

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1,	-	-	-	-	-	-	-	-	[2]	-	0.95	-
2,	-	-	-	[2]	-	-	-	-	[2]	-	-	1.21
3,	-	-	-	1.47[3]	-	0.10	-	0.27	0.74	-	-	-
4,	-	-	[2]	-	-	-	-	-	-	-	-	-
5,	0.05[1]	-	0.06[1]	-	[2]	-	-	-	-	-	-	-
6,	-	-	[2]	-	[2]	0.21	-	-	0.14	-	-	0.47
7,	-	-	0.04	0.47[3]	[2]	-	-	-	-	-	1.76	-
8,	[2]	-	[2]	-	[2]	-	-	-	-	-	-	-
9,	0.72[3]	-	0.27	0.11[3]	1.66	-	-	-	-	-	-	-
10,	-	-	-	-	-	-	-	[2]	-	0.18	-	-
11,	-	-	-	-	-	-	0.19	0.98	0.09	[2]	-	-
12,	0.19[1]	-	[2]	0.13	0.21	-	-	-	-	0.15	-	-
13,	-	-	1.50	-	-	-	-	-	-	-	[2]	-
14,	-	-	[2]	[2]	-	-	0.10	-	-	-	0.70	-
15,	0.65[1]	-	1.10	0.27	-	-	-	-	[2]	-	-	-
16,	-	-	-	0.37	0.95	0.06	-	-	1.00	-	-	-
17,	0.05[1]	-	-	[2]	-	0.15	-	-	-	-	-	-
18,	-	-	-	[2]	-	-	1.00	0.68	-	-	-	[2]
19,	0.38	-	-	0.98	-	-	-	-	[2]	0.10	-	0.75
20,	-	0.37[3]	0.12	-	0.21	-	-	0.38	[2]	-	-	-
21,	-	[2]	0.31[3]	-	0.45	-	0.95	-	0.16	-	-	-
22,	[2]	1.25[3]	-	0.27	-	-	-	-	-	[2]	-	-
23,	0.23[3]	-	-	-	-	-	-	0.17	-	1.40	-	-
24,	-	-	1.06[3]	0.08	0.40	-	-	-	-	0.10	0.73	0.45[1]
25,	-	-	-	-	-	-	-	-	-	0.25	-	-
26,	-	0.90[3]	-	-	-	-	-	-	-	-	-	-
27,	-	-	-	0.18	-	-	-	-	-	-	-	1.25[3]
28,	-	-	[2]	-	-	-	-	-	-	-	0.05[1]	-
29,	[2]	-	1.20	[2]	[2]	-	0.34	-	0.36	-	-	-
30,	[2]	-	-	0.04[3]	[2]	-	-	-	-	-	-	1.11
31,	0.45[3]	-	-	-	1.26	-	0.19	-	-	-	-	-
Totals,	2.72	2.52	5.66	4.37	5.14	0.52	2.77	2.48	2.49	2.18	4.19	5.24

Total for the year 40.28 inches.

[1] Snow. [2] Rainfall included in that of following day. [3] Rain and snow.

TABLE No. 3. — *Rainfall in Inches at Framingham, Mass., in 1912.*

DAY OF MONTH.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1,	–	–	–	[2]	–	–	–	–	[2]	0.02	0.53	–
2,	–	–	–	[2]	–	–	–	0.12	[2]	–	–	0.62
3,	–	–	–	0.87[3]	–	–	–	–	[2]	–	–	–
4,	–	–	[2]	–	–	–	–	–	0.39	–	–	–
5,	0.03[1]	–	0.07[1]	0.03[3]	[2]	–	–	–	–	–	–	[2]
6,	–	–	[2]	–	[2]	0.21	–	–	0.25	–	–	0.41
7,	–	–	0.05[3]	0.45	[2]	–	–	–	–	–	[2]	–
8,	[2]	–	0.06	–	1.17	–	–	–	–	–	1.72	–
9,	0.94[3]	–	–	0.05[3]	[2]	–	0.03	–	–	0.03	–	–
10,	–	–	–	–	0.33	–	–	–	–	–	–	–
11,	–	–	–	–	–	–	0.57	0.88	0.19	[2]	–	–
12,	0.17[1]	–	[2]	0.07	[2]	–	–	–	–	0.11	–	0.01[1]
13,	–	–	2.29	–	0.47	–	–	–	–	–	[2]	–
14,	–	–	–	[2]	–	–	0.03	0.47	–	–	0.66	–
15,	0.95[3]	–	1.17	[2]	–	–	–	0.01	[2]	–	–	–
16,	–	–	–	0.57	[2]	0.03	–	–	0.65	–	–	–
17,	0.07[1]	–	–	[2]	0.87	0.07	–	–	–	–	–	–
18,	[2]	–	–	[2]	–	–	0.90	0.54	–	–	–	[2]
19,	0.10	[2]	[2]	1.09	–	–	–	[2]	0.02	0.04	–	1.13
20,	–	0.14	[2]	–	0.08	–	–	0.86	0.03	–	–	–
21,	–	[2]	0.64[3]	[2]	0.35	0.03	1.18	–	–	–	–	–
22,	[2]	1.34[3]	–	[2]	–	–	–	–	–	–	–	–
23,	0.04[3]	–	–	0.39	–	–	–	0.04	–	2.14	–	–
24,	–	–	0.97[3]	0.03	0.10	–	–	–	–	0.07	0.57	0.55[1]
25,	–	–	–	–	–	[2]	–	–	–	0.17	0.01[1]	–
26,	–	[2]	–	[2]	0.46	0.04	–	–	–	–	–	[2]
27,	0.01[1]	1.16	–	0.05	–	–	–	–	–	–	–	1.27[3]
28,	–	–	[2]	–	–	–	–	–	–	–	0.05[1]	–
29,	[2]	–	1.08	[2]	[2]	–	0.41	–	0.17	–	–	–
30,	[2]	–	–	0.52[3]	[2]	–	–	–	–	–	–	1.03
31,	0.53[3]	–	–	–	0.37	–	0.23	–	–	–	–	–
Totals,	2.84	2.64	6.33	4.12	4.20	0.38	3.35	2.92	1.70	2.58	3.54	5.02

Total for the year 39.62 inches.

[1] Snow.
[2] Rainfall included in that of following day.
[3] Rain and snow.

TABLE NO. 4. — *Rainfall in Inches at Chestnut Hill Reservoir in 1912.*

DATE.	Amount.	Duration.
Jan. 5,	.14[1]	7.00 A.M. to 2.00 P.M.
Jan. 8,	.81[2]	6.00 P.M. to 9.30 A.M.
Jan. 9,		
Jan. 12,	.22[1]	7.30 A.M. to 8.00 P.M.
Jan. 15,	1.09[1]	12.35 A.M. to 10.30 A.M.
Jan. 15,	.23	10.30 A.M. to 6.00 P.M.
Jan. 17,	.13[1]	9.45 P.M. to 11.50 P.M.
Jan. 19,	.14	6.15 A.M. to 1.30 P.M.
Jan. 22,	.04[1]	8.45 P.M. to 11.50 P.M.
Jan. 27,	.08[1]	7.30 A.M. to 4.30 P.M.
Jan. 29,	.56[1]	8.30 A.M. to 4.00 P.M.
Jan. 30,		
Jan. 31,	.20[1]	6.30 A.M. to 2.30 P.M.
Total,	3.64	
Feb. 8,	.03[1]	3.10 A.M. to 8.00 A.M.
Feb. 20,	.16	2.10 A.M. to 9.30 A.M.
Feb. 21,	1.08	3.30 P.M. to 7.10 A.M.
Feb. 22,		
Feb. 26,	1.21[2]	8.00 P.M. to 6.25 A.M.
Feb. 27,		
Total,	2.48	
Mar. 4,	.08[1]	10.20 P.M. to 4.40 A.M.
Mar. 5,		
Mar. 6,	.11[1]	5.30 P.M. to 3.40 A.M.
Mar. 7,		
Mar. 8,	.04	9.20 P.M. to 10.30 P.M.
Mar. 12,	1.38	2.00 P.M. to 7.45 P.M.
Mar. 13,		
Mar. 15,	.93	7.30 A.M. to 8.45 P.M.
Mar. 20,	.27	12.25 A.M. to 6.40 A.M.
Mar. 21,	.48[1]	3.55 A.M. to 9.40 P.M.
Mar. 24,	.55[1]	3.10 A.M. to 7.55 A.M.
Mar. 24,	.41	7.55 A.M. to 5.00 P.M.
Mar. 24,	.11[1]	10.45 P.M. to 2.35 A.M.
Mar. 25,		
Mar. 28,	1.00	9.30 P.M. to 2.00 P.M.
Mar. 29,		
Total,	5.36	
Apr. 1,	.86	7.00 P.M. to 4.10 A.M.
Apr. 3,		
Apr. 5,	.08[2]	6.45 A.M. to 8.45 A.M.
Apr. 7,	.51	7.50 P.M. to 12.50 A.M.
Apr. 8,		
Apr. 9,	.09[2]	1.00 P.M. to 10.30 P.M.
Apr. 12,	.08	4.15 P.M. to 8.00 P.M.
Apr. 14,	.23	1.50 A.M. to 12.15 P.M.
Apr. 15,	.04	12.01 A.M. to 7.30 A.M.
Apr. 16,	.07	1.20 A.M. to 7.30 A.M.
Apr. 16,	.11	6.40 P.M. to 8.35 P.M.
Apr. 17,	.86	6.30 P.M. to 1.35 P.M.
Apr. 19,		
Apr. 22,	.40	2.05 A.M. to 8.45 A.M.
Apr. 23,		
Apr. 24,	.05	6.30 P.M. to 8.30 P.M.
Apr. 27,	.10	4.05 A.M. to 7.30 A.M.
Apr. 29,	.44	2.30 P.M. to 6.30 A.M.
Total,	3.92	
May 5,	.49	9.30 P.M. to 1.15 A.M.
May 7,		
May 8,	.80	4.50 A.M. to 5.20 A.M.
May 9,		
May 9,	.33	4.20 P.M. to 5.30 A.M.
May 10,		
May 12,	.26	10.30 A.M. to 9.00 P.M.
May 13,		
May 16,	.78	8.00 A.M. to 6.00 A.M.
May 17,		
May 21,	.32	9.15 P.M. to 11.40 P.M.
May 24,	.30	5.30 P.M. to 8.30 P.M.
May 26,	.40	1.30 A.M. to 4.35 A.M.
May 29,	.38	11.20 P.M. to 4.00 P.M.
May 31,		
Total,	4.06	
June 6,	.30	12.45 P.M. to 11.00 P.M.
June 25,	.04	6.00 P.M. to 2.15 A.M.
June 26,		
Total,	.34	
July 11,	1.05	11.00 A.M. to 12.15 P.M.
July 11,	.52	2.30 P.M. to 12.15 A.M.
July 12,		
July 18,	3.27	10.15 A.M. to 11.30 P.M.
July 21,	.95	4.55 A.M. to 9.00 P.M.
July 29,	.40	8.30 A.M. to 11.50 A.M.
July 29,	.03	8.00 P.M. to 8.30 P.M.
Aug. 1,	.17	2.10 A.M. to 7.30 A.M.
Total,	6.39	
Aug. 3,	.14	3.00 A.M. to 4.15 A.M.
Aug. 11,	.45	2.20 A.M. to 6.35 A.M.
Aug. 11,	.20	7.40 A.M. to 11.45 A.M.
Aug. 14,	.06	11.45 A.M. to 12.45 P.M.
Aug. 15,	.33	5.15 P.M. to 8.00 P.M.
Aug. 18,	.48	5.55 A.M. to 4.30 P.M.
Aug. 20,	.53	1.30 A.M. to 7.30 A.M.
Aug. 23,	.05	12.50 P.M. to 3.00 P.M.
Total,	2.24	
Sept. 1,	.45	2.30 P.M. to 7.20 A.M.
Sept. 2,		
Sept. 2,	.04	8.15 P.M. to 2.50 A.M.
Sept. 3,		
Sept. 4,	.04	6.05 A.M. to 6.30 A.M.
Sept. 6,	.15	2.30 A.M. to 5.45 A.M.
Sept. 11,	.19	1.45 P.M. to 5.30 P.M.
Sept. 15,	.71	10.45 P.M. to 3.45 A.M.
Sept. 16,		
Sept. 19,	.05	8.30 P.M. to 11.15 P.M.
Sept. 29,	.09	12.15 P.M. to 8.00 P.M.
Total,	1.72	

[1] Snow.

[2] Rain and snow.

TABLE No. 4. — *Rainfall in Inches at Chestnut Hill Reservoir in 1912* — Concluded.

DATE.	Amount.	Duration.
Oct. 1,	.04	3.20 P.M. to 3.40 P.M.
Oct. 9,	.05	7.45 P.M. to 3.25 A.M.
Oct. 10,		
Oct. 11,	.09	5.05 A.M. to 7.30 A.M.
Oct. 12,		
Oct. 19,	.03	1.15 P.M. to 6.00 P.M.
Oct. 23,	1.08	10.15 A.M. to 7.15 P.M.
Oct. 24,		
Oct. 25,	.32	10.00 A.M. to 2.25 A.M.
Oct. 26,		
Total,	1.61	
Nov. 1,	.56	11.45 A.M. to 10.00 P.M.
Nov. 7,	1.24	2.30 P.M. to 6.00 A.M.
Nov. 8,		
Nov. 13,	.54	6.00 P.M. to 9.00 P.M.
Nov. 14,		
Nov. 24,	.45	11.30 A.M. to 10.00 P.M.
Nov. 28,	.21[1]	10.30 A.M. to 3.35 P.M.
Total,	3.00	
Dec. 2,	.50	2.30 P.M. to 10.00 P.M.
Dec. 6,	.43	2.30 A.M. to 7.45 A.M.
Dec. 17,	1.25	11.05 P.M. to 2.30 P.M.
Dec. 19,		
Dec. 24,	.64[1]	7.15 A.M. to 4.45 P.M.
Dec. 27,	1.13	3.30 A.M. to 3.00 P.M.
Dec. 27,	.15[1]	3.00 P.M. to 8.30 P.M.
Dec. 30,	1.05	7.00 A.M. to 7.35 P.M.
Jan. 1,	.05	3.20 A.M. to 6.25 A.M.
Total,	5.20	

Total for year 39.96 inches.

[1] Snow.

TABLE NO. 5. — *Rainfall in Inches on the Wachusett Watershed,*[1] *1897 to 1912.*

YEAR.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.
1897,	3.46	2.86	4.01	2.32	5.06	5.11	8.65	3.47	1.93	0.94	7.62	6.41	51.84
1898,	6.65	3.30	2.27	4.43	3.38	3.11	3.01	10.61	3.15	7.21	6.81	3.99	57.92
1899,	2.93	5.12	6.75	1.94	1.33	5.51	3.82	3.20	4.11	2.72	1.94	2.03	41.40
1900,	4.56	8.69	6.19	2.76	4.34	3.59	3.20	3.18	3.46	2.90	6.44	3.15	52.46
1901,	1.75	1.13	5.82	9.64	7.02	1.51	5.66	4.58	3.10	3.70	2.43	9.36	55.70
1902,	2.72	4.91	5.27	4.36	2.24	2.51	3.87	3.95	4.26	6.36	0.93	7.20	48.58
1903,	2.85	4.42	6.58	3.10	1.24	10.37	3.43	3.88	2.93	4.43	2.36	3.99	49.58
1904,	4.02	2.66	3.40	7.45	2.99	3.44	3.84	3.68	5.30	1.78	1.62	2.88	43.06
1905,	6.10	1.72	3.95	2.60	0.83	4.88	5.39	3.09	6.90	1.81	2.52	3.79	43.58
1906,	2.59	2.74	5.17	3.12	6.58	5.95	5.52	4.34	2.61	3.95	2.25	4.26	49.08
1907,	2.84	2.32	1.82	2.65	2.96	3.54	3.03	1.26	9.50	5.68	5.74	4.40	45.74
1908,	3.40	4.82	2.77	2.62	5.34	1.29	3.85	6.49	1.04	2.13	1.05	3.03	37.83
1909,	3.52	6.10	4.38	5.71	2.65	3.03	4.25	3.59	3.90	1.70	1.68	3.99	44.50
1910,	5.86	5.24	1.09	3.01	2.13	4.36	1.52	3.87	2.86	1.40	4.17	2.34	37.85
1911,	2.91	2.43	3.79	2.22	1.59	2.37	2.53	5.46	3.04	5.24	4.14	3.01	38.73
1912,	2.57	2.42	5.69	4.06	5.76	0.48	2.65	2.89	2.17	2.53	4.02	4.95	40.19
Totals,	58.73	60.88	68.95	61.99	55.44	61.05	64.22	67.54	60.26	54.48	55.72	68.78	738.04
Average (16 years),	3.67	3.81	4.31	3.87	3.47	3.82	4.01	4.22	3.77	3.40	3.48	4.30	46.13

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[1] Means of observations at four places, as follows: January, 1897, to December, 1900, Princeton, Jefferson, Sterling and South Clinton; January, 1901, to December, 1912, Princeton, Jefferson, Sterling and Boylston.

TABLE NO. 6. — *Rainfall in Inches on the Sudbury Watershed,*[1] *1875 to 1912.*

YEAR.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.
1875,	2.42	3.15	3.74	3.23	3.56	6.24	3.57	5.53	3.43	4.85	4.83	0.94	45.49
1876,	1.83	4.21	7.43	4.20	2.76	2.04	9.13	1.72	4.62	2.24	5.76	3.62	49.56
1877,	3.22	0.74	8.36	3.43	3.70	2.43	2.95	3.68	0.32	8.52	5.80	0.87	44.02
1878,	5.63	5.97	4.69	5.79	0.96	3.88	2.97	6.94	1.29	6.42	7.02	6.37	57.93
1879,	2.48	3.56	5.14	4.72	1.58	3.79	3.93	6.51	1.88	0.81	2.68	4.34	41.42
1880,	3.57	3.98	3.31	3.11	1.84	2.14	6.27	4.01	1.60	3.74	1.78	2.83	38.18
1881,	5.56	4.65	5.73	2.00	3.51	5.39	2.35	1.36	2.62	2.95	4.09	3.96	44.17
1882,	5.95	4.55	2.65	1.82	5.07	1.66	1.77	1.67	8.74	2.07	1.15	2.30	39.40
1883,	2.81	3.87	1.78	1.84	4.19	2.40	2.68	0.73	1.52	5.60	1.81	3.55	32.78
1884,	5.09	6.54	4.72	4.41	3.47	3.44	3.67	4.65	0.85	2.48	2.65	5.17	47.14
1885,	4.71	3.87	1.07	3.60	3.48	2.87	1.43	7.18	1.43	5.09	6.09	2.72	43.54
1886,	6.36	6.28	3.61	2.22	3.00	1.47	3.27	4.10	2.90	3.24	4.64	4.97	46.06
1887,	5.20	4.78	4.90	4.27	1.16	2.65	3.76	5.28	1.32	2.83	2.67	3.88	42.70
1888,	4.15	3.68	6.02	2.43	4.82	2.54	1.41	6.22	8.59	4.99	7.22	5.40	57.47
1889,	5.37	1.65	2.37	3.41	2.95	2.80	8.94	4.18	4.60	4.25	6.29	3.14	49.95
1890,	2.53	3.51	7.73	2.64	5.21	2.03	2.46	3.87	6.00	10.51	1.20	5.31	53.00
1891,	7.02	5.23	6.48	3.91	2.01	3.77	3.39	4.73	2.38	3.83	3.09	3.68	49.52
1892,	5.85	3.14	4.06	0.83	5.58	2.76	4.23	4.44	2.84	1.17	5.80	1.13	41.83
1893,	2.92	8.20	3.67	3.60	6.61	2.38	2.57	5.41	1.74	4.07	2.20	4.86	48.23
1894,	4.09	3.91	1.43	3.42	4.24	1.15	3.26	2.03	2.63	5.34	3.43	4.81	39.74

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[1] See note at end of this table.

TABLE NO. 6. — *Rainfall in Inches on the Sudbury Watershed,*[1] *1875 to 1912* — Concluded.

YEAR.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Totals.
1895,	4.06	1.39	2.98	5.25	2.02	2.77	5.04	4.15	2.30	10.68	6.63	3.35	50.62
1896,	2.39	7.18	5.24	1.57	2.57	3.22	2.51	2.40	7.72	3.76	3.02	2.12	43.70
1897,	4.00	2.91	3.66	2.82	4.37	4.46	5.44	3.51	2.94	0.47	6.40	5.21	46.19
1898,	6.83	4.49	2.40	4.66	3.22	2.48	4.09	8.17	2.62	6.71	6.93	3.28	55.88
1899,	4.18	4.91	7.01	1.90	1.45	2.51	3.22	1.43	3.95	2.69	2.18	1.78	37.21
1900,	4.96	9.14	6.35	2.58	4.32	2.99	2.42	2.26	3.36	3.83	5.70	2.74	50.65
1901,	1.82	1.52	6.57	8.60	7.23	1.38	5.71	4.57	3.30	2.82	2.90	9.69	56.11
1902,	2.52	6.18	5.34	4.13	1.86	2.89	2.94	3.40	4.54	4.44	1.45	6.38	46.07
1903,	3.80	3.95	6.63	2.99	0.93	9.25	2.77	3.67	1.75	4.72	1.56	3.14	45.16
1904,	4.87	3.00	2.72	8.87	2.65	2.80	1.96	3.86	5.80	1.64	1.73	2.92	42.82
1905,	5.26	2.20	3.15	2.72	1.31	5.00	5.47	2.70	6.88	1.54	2.07	4.01	42.31
1906,	2.47	2.92	6.32	2.88	5.66	3.91	3.42	3.02	3.30	3.40	2.69	4.49	44.48
1907,	3.28	2.17	1.91	3.41	3.63	3.53	1.86	1.07	8.76	4.17	6.12	4.47	44.38
1908,	3.60	4.56	3.82	1.88	5.51	0.86	3.71	4.57	0.97	2.55	0.98	3.14	36.15
1909,	3.98	5.79	4.26	4.67	2.43	2.81	1.59	2.93	4.74	1.12	3.38	4.05	41.75
1910,	5.39	5.06	0.85	2.75	1.29	4.68	2.03	2.62	2.49	1.86	4.13	2.49	35.64
1911,	2.88	2.77	3.59	2.81	1.01	2.53	3.19	4.94	2.75	3.69	4.62	3.60	38.38
1912,	2.94	2.77	6.46	4.37	4.55	0.46	3.24	3.05	1.76	2.35	3.64	5.13	40.72
Totals,	155.99	158.38	168.15	133.74	125.71	116.36	134.62	146.56	131.23	147.44	146.33	145.84	1,710.35
Average (38 years),	4.11	4.17	4.42	3.52	3.31	3.06	3.54	3.86	3.45	3.88	3.85	3.84	45.01

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[1] Means of observations at several places, as follows: January, 1875, to March, 1876, inclusive, Lake Cochituate; April and May, 1876, Lake Cochituate, Westborough and Hopkinton; June to November, 1876, inclusive, Lake Cochituate, Southborough, Marlborough, Westborough and Hopkinton; December, 1876, to December, 1882, inclusive, Framingham, Southborough, Marlborough, Westborough and Hopkinton; January, 1883, to December, 1889, inclusive, Framingham and Westborough; January, 1890, to May, 1898, inclusive, Framingham and Ashland Dam; June, 1898, to December, 1912, inclusive, Framingham, Ashland Dam, Cordaville and Sudbury Dam.

TABLE NO. 7. — *Yield of the Wachusett Watershed in Gallons per Day per Square Mile*[1] *from 1897 to 1912.*

MONTH.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.	1905.
January,	796,000	1,563,000	2,092,000	796,000	519,000	1,676,000	1,265,000	659,000	1,266,000
February,	931,000	1,635,000	1,090,000	4,054,000	356,000	1,401,000	2,133,000	927,000	452,000
March,	2,760,000	3,088,000	2,776,000	3,722,000	2,718,000	3,992,000	3,423,000	3,008,000	3,004,000
April,	1,632,000	2,027,000	3,376,000	1,580,000	4,986,000	2,159,000	2,238,000	2,984,000	1,617,000
May,	1,163,000	1,390,000	862,000	1,382,000	2,729,000	1,031,000	569,000	1,498,000	445,000
June,	1,181,000	828,000	561,000	578,000	985,000	410,000	2,131,000	762,000	542,000
July,	1,442,000	333,000	354,000	217,000	477,000	292,000	624,000	497,000	365,000
August,	896,000	1,325,000	236,000	197,000	512,000	297,000	474,000	355,000	321,000
September,	380,000	676,000	250,000	127,000	320,000	241,000	375,000	494,000	1,228,000
October,	243,000	1,509,000	245,000	282,000	647,000	950,000	689,000	347,000	367,000
November,	1,283,000	2,170,000	430,000	875,000	517,000	635,000	634,000	343,000	442,000
December,	2,275,000	2,061,000	359,000	1,570,000	3,234,000	1,848,000	954,000	440,000	1,018,000
Average,	1,253,000	1,551,000	1,051,000	1,264,000	1,507,000	1,248,000	1,285,000	1,025,000	926,000
Average driest six months,	886,000	1,013,000	312,000	377,000	576,000	471,000	626,000	413,000	541,000

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[1] See note at end of this table.

TABLE NO. 7. — *Yield of the Wachusett Watershed in Gallons per Day per Square Mile*[1] *from 1897 to 1912* — Concluded.

MONTH.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	Mean for 16 Years, 1897-1912.
January,	1,132,000	1,458,000	1,738,000	592,000	1,846,000	773,000	780,000	1,184,000
February,	1,027,000	692,000	1,736,000	2,556,000	1,845,000	625,000	927,000	1,398,000
March,	1,860,000	1,697,000	2,192,000	2,129,000	2,640,000	1,339,000	2,831,000	2,698,000
April,	2,109,000	1,436,000	1,269,000	2,422,000	1,034,000	1,393,000	2,281,000	2,159,000
May,	1,533,000	965,000	1,415,000	1,212,000	608,000	461,000	1,797,000	1,191,000
June,	1,184,000	773,000	403,000	632,000	824,000	351,000	331,000	780,000
July,	728,000	335,000	220,000	233,000	62,000	57,000	135,000	398,000
August,	591,000	87,000	443,000	193,000	186,000	188,000	125,000	402,000
September,	277,000	810,000	88,000	208,000	145,000	181,000	89,000	368,000
October,	530,000	1,382,000	158,000	90,000	68,000	718,000	145,000	523,000
November,	749,000	2,540,000	125,000	363,000	354,000	1,035,000	442,000	809,000
December,	794,000	1,961,000	387,000	537,000	391,000	1,067,000	793,000	1,231,000
Average,	1,043,000	1,180,000	847,000	918,000	828,000	682,000	891,000	1,094,000
Average driest six months,	613,000	725,000	238,000	270,000	201,000	327,000	210,000	545,000

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[1] The area of the watershed used in making up these records included water surfaces amounting to 2.2 per cent. of the whole area from 1897 to 1902, inclusive, 2.4 per cent. in 1903, 3.6 per cent. in 1904, 4.1 per cent. in 1905, 5.1 per cent. in 1906, 6.0 per cent. in 1907, 7.0 per cent. in 1908, 1909, and 1910, 6.5 per cent. in 1911, and 6.8 per cent. in 1912.

TABLE NO. 8. — *Yield of the Sudbury Watershed in Gallons per Day per Square Mile*[1] *from 1875 to 1912.*

MONTH.	1875.	1876.	1877.	1878.	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.
January,	103,000	643,000	658,000	1,810,000	700,000	1,120,000	415,000	1,241,000	335,000	995,000	1,235,000	1,461,000	2,589,000
February,	1,496,000	1,368,000	949,000	2,465,000	1,711,000	1,787,000	1,546,000	2,403,000	1,033,000	2,842,000	1,354,000	4,801,000	2,829,000
March,	1,604,000	4,435,000	4,814,000	3,507,000	2,330,000	1,374,000	4,004,000	2,839,000	1,611,000	3,785,000	1,572,000	2,059,000	2,868,000
April,	3,049,000	3,292,000	2,394,000	1,626,000	3,116,000	1,169,000	1,546,000	867,000	1,350,000	2,853,000	1,815,000	1,947,000	2,620,000
May,	1,188,000	1,138,000	1,391,000	1,394,000	1,114,000	514,000	965,000	1,292,000	937,000	1,030,000	1,336,000	720,000	1,009,000
June,	870,000	222,000	597,000	506,000	413,000	175,000	1,338,000	529,000	300,000	416,000	426,000	203,000	413,000
July,	321,000	183,000	202,000	128,000	157,000	176,000	276,000	86,000	115,000	224,000	62,000	116,000	115,000
August,	396,000	405,000	121,000	476,000	395,000	119,000	148,000	55,000	79,000	257,000	240,000	94,000	214,000
September,	207,000	184,000	60,000	161,000	141,000	80,000	197,000	307,000	91,000	44,000	121,000	117,000	111,000
October,	646,000	234,000	631,000	516,000	71,000	102,000	186,000	299,000	186,000	83,000	336,000	146,000	190,000
November,	1,302,000	1,088,000	1,418,000	1,693,000	206,000	205,000	395,000	209,000	205,000	175,000	1,177,000	673,000	369,000
December,	584,000	453,000	1,290,000	3,177,000	463,000	175,000	775,000	315,000	194,000	925,000	1,174,000	1,020,000	643,000
Average,	972,000	1,135,000	1,214,000	1,452,000	894,000	578,000	979,000	862,000	533,000	1,129,000	901,000	1,087,000	1,154,000
Average, driest six months,	574,000	384,000	502,000	532,000	230,000	143,000	330,000	211,000	145,000	200,000	391,000	223,000	234,000

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[1] See note at end of this table.

TABLE No. 8. — *Yield of the Sudbury Watershed in Gallons per Day per Square Mile*[1] *from 1875 to 1912* — Continued.

MONTH.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	1895.	1896.	1897.	1898.	1899.	1900.
January,	1,053,000	2,782,000	1,254,000	3,018,000	1,870,000	434,000	693,000	1,034,000	1,084,000	845,000	1,638,000	2,288,000	794,000
February,	1,950,000	1,196,000	1,529,000	3,486,000	943,000	1,542,000	991,000	541,000	2,676,000	1,067,000	3,022,000	1,381,000	3,800,000
March,	3,238,000	1,338,000	3,643,000	4,453,000	1,955,000	3,245,000	2,238,000	2,410,000	3,835,000	2,565,000	2,604,000	4,205,000	3,654,000
April,	2,645,000	1,410,000	1,875,000	2,397,000	871,000	2,125,000	1,640,000	2,515,000	1,494,000	1,515,000	1,829,000	2,521,000	1,350,000
May,	1,632,000	880,000	1,366,000	583,000	1,259,000	2,883,000	840,000	636,000	360,000	915,000	1,246,000	511,000	1,312,000
June,	421,000	653,000	568,000	413,000	428,000	440,000	419,000	174,000	399,000	962,000	530,000	66,000	316,000
July,	117,000	634,000	107,000	149,000	214,000	158,000	161,000	231,000	95,000	658,000	231,000	19,000	—18,000
August,	379,000	1,432,000	132,000	163,000	280,000	181,000	209,000	229,000	57,000	591,000	1,107,000	—35,000	—34,000
September,	1,155,000	823,000	457,000	203,000	229,000	108,000	150,000	89,000	388,000	182,000	369,000	94,000	65,000
October,	1,999,000	1,230,000	2,272,000	210,000	126,000	222,000	374,000	1,379,000	592,000	94,000	1,160,000	115,000	186,000
November,	2,758,000	1,941,000	1,215,000	305,000	697,000	319,000	836,000	2,777,000	659,000	909,000	1,986,000	304,000	663,000
December,	3,043,000	2,241,000	996,000	544,000	485,000	796,000	716,000	1,782,000	657,000	1,584,000	1,799,000	220,000	1,096,000
Average,	1,697,000	1,383,000	1,285,000	1,315,000	781,000	1,037,000	770,000	1,152,000	1,019,000	991,000	1,450,000	973,000	1,082,000
Average, driest six months,	953,000	944,000	747,000	239,000	327,000	237,000	356,000	460,000	314,000	564,000	777,000	93,000	194,000

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[1] See note at end of this table.

TABLE No. 8. — *Yield of the Sudbury Watershed in Gallons per Day per Square Mile*[1] *from 1875 to 1912* — Concluded.

MONTH.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	1912.	Mean for 38 Years, 1875–1912.
January, ...	437,000	1,763,000	1,736,000	477,000	1,410,000	1,128,000	1,351,000	1,925,000	392,000	1,490,000	519,000	728,000	1,196,000
February, ...	300,000	1,674,000	2,279,000	882,000	330,000	1,041,000	624,000	1,536,000	2,286,000	1,849,000	700,000	1,197,000	1,721,000
March, ...	2,755,000	4,199,000	3,454,000	2,999,000	2,497,000	2,409,000	1,658,000	2,257,000	1,734,000	1,954,000	1,144,000	3,092,000	2,798,000
April, ...	4,204,000	1,885,000	2,261,000	3,294,000	1,643,000	1,949,000	1,607,000	1,117,000	1,721,000	667,000	1,426,000	2,235,000	1,996,000
May, ...	2,954,000	743,000	351,000	1,745,000	297,000	1,059,000	888,000	1,046,000	1,004,000	277,000	318,000	1,447,000	1,068,000
June, ...	753,000	303,000	1,987,000	419,000	467,000	707,000	761,000	194,000	239,000	516,000	213,000	148,000	498,000
July, ...	306,000	66,000	445,000	62,000	177,000	398,000	9,000	—14,000	—121,000	—102,000	—14,000	—77,000	159,000
August, ...	424,000	135,000	307,000	170,000	114,000	180,000	—104,000	102,000	—45,000	—73,000	20,000	—29,000	234,000
September, ...	305,000	178,000	130,000	397,000	1,246,000	19,000	541,000	—82,000	149,000	5,000	76,000	—28,000	239,000
October, ...	412,000	506,000	492,000	191,000	158,000	301,000	741,000	47,000	—51,000	—51,000	296,000	—14,000	437,000
November, ...	474,000	444,000	363,000	289,000	279,000	483,000	1,998,000	71,000	82,000	176,000	593,000	165,000	787,000
December, ...	2,695,000	1,779,000	582,000	269,000	887,000	659,000	2,032,000	136,000	263,000	221,000	908,000	494,000	1,002,000
Average, ...	1,342,000	1,140,000	1,190,000	931,000	795,000	860,000	1,010,000	694,000	625,000	570,000	514,000	779,000	1,007,000
Average, driest six months, .	445,000	271,000	388,000	228,000	403,000	341,000	471,000	44,000	40,000	29,000	151,000	26,000	389,000

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[1] The area of the Sudbury watershed used in making up these records included water surfaces amounting to 1.9 per cent. of the whole area from 1875 to 1878, inclusive, and was subsequently increased by the construction of storage reservoirs to 3.0 per cent. in 1879, 3.4 per cent. in 1885, 3.9 per cent. in 1894, and 6.5 per cent. in 1898. The watershed also contains extensive areas of swampy land, which, though covered with water at times, are not included in the above percentages of water surfaces.

NOTE. — The recorded yields, subsequent to the year 1897, are less accurate than those for previous years, particularly during months of small yield, due to unavoidable inaccuracies in the measurement of large quantities of water received from the Wachusett Reservoir.

TABLE NO. 9. — *Wachusett System. — Statistics of Flow of Water, Storage and Rainfall in 1912.*

[Watershed above dam = 118.19 square miles.]

MONTH.	GALLONS PER DAY.									
	Discharged into Wachusett Aqueduct.[1]	Diverted to the City of Worcester.	Wasted into River below Dam.	Seepage through the North Dike.	STORAGE.[2]		Total Yield of Watershed.	Rainfall (Inches).	Rainfall collected (Inches).	Percentage of Rainfall collected.
					Gain.	Loss.				
January,	66,900,000	84,000	1,778,000	800,000	22,690,000	-	92,252,000	2.57	1.392	54.2
February,	118,790,000	1,045,000	1,772,000	800,000	-	12,848,000	109,559,000	2.42	1.547	63.8
March,	23,533,000	2,335,000	1,755,000	842,000	306,116,000	-	334,581,000	5.69	5.050	88.8
April,	76,773,000	-	1,757,000	993,000	190,090,000	-	269,613,000	4.06	3.938	97.0
May,	132,942,000	-	48,761,000	1,000,000	29,665,000	-	212,368,000	5.76	3.206	55.7
June,	79,683,000	-	11,207,000	1,000,000	-	52,767,000	39,123,000	0.48	0.571	119.6
July,	150,719,000	39,000	2,264,000	1,000,000	-	138,119,000	15,903,000	2.65	0.240	9.1
August,	77,639,000	116,000	2,619,000	900,000	-	66,461,000	14,813,000	2.89	0.224	7.7
September,	78,633,000	137,000	2,020,000	900,000	-	71,130,000	10,560,000	2.17	0.154	7.1
October,	100,239,000	2,710,000	2,645,000	877,000	-	89,348,000	17,123,000	2.53	0.258	10.2
November,	101,560,000	5,053,000	1,900,000	847,000	-	57,173,000	52,187,000	4.02	0.762	18.9
December,	100,816,000	4,481,000	1,842,000	813,000	-	14,265,000	93,687,000	4.95	1.414	28.5
Total,	-	-	-	-	-	-	-	40.19	18.756	-
Average for year,	92,298,000	1,335,000	6,747,000	898,000	3,979,000	-	105,257,000	-	-	46.7

[1] Including 171,000 gallons per day drawn from aqueduct for the supply of the Westborough State Hospital.

[2] Aggregate storage in Wachusett Reservoir and in ponds and mill reservoirs.

TABLE NO. 10. — *Sudbury System. — Statistics of Flow of Water, Storage and Rainfall in 1912.*

[Watershed from 1875 to 1878 inclusive = 77.764 square miles; in 1879 and 1880 = 78.238 square miles; and from 1881 to 1912 inclusive = 75.2 square miles.]

MONTH.	GALLONS PER DAY.											
	Water received from Wachusett Reservoir.[1]	Water discharged through Sudbury Aqueduct.[2]	Water discharged through Weston Aqueduct.	Water used by Framingham Water Works.	Water diverted from Watershed by Sewers, etc.	Water wasted into River below Lowest Dam.	STORAGE.		Total Yield of Watershed.	Rainfall (Inches).	Rainfall collected (Inches).	Percentage of Rainfall collected.
							Gain.	Loss.				
January,	66,748,000	93,377,000	36,507,000	861,000	1,135,000	12,455,000	-	22,832,000	54,755,000	2.94	1.299	44.1
February,	118,634,000	97,335,000	36,424,000	955,000	1,003,000	30,710,000	42,235,000	-	90,028,000	2.77	1.998	72.2
March,	23,365,000	77,955,000	35,777,000	816,000	2,461,000	117,023,000	21,823,000	-	232,490,000	6.46	5.516	85.3
April,	76,607,000	70,360,000	35,547,000	710,000	2,570,000	102,487,000	33,033,000	-	168,100,000	4.37	3.859	88.3
May,	132,774,000	73,226,000	36,506,000	716,000	2,148,000	80,813,000	48,142,000	-	108,777,000	4.55	2.580	56.7
June,	79,507,000	75,580,000	36,723,000	853,000	1,244,000	11,993,000	-	35,763,000	11,123,000	0.46	0.255	56.1
July,	150,529,000	82,110,000	36,664,000	903,000	764,000	1,500,000	22,823,000	-	—5,765,000	3.24	—0.137	—4.2
August,	77,461,000	68,200,000	36,439,000	803,000	787,000	1,645,000	-	32,629,000	—2,216,000	3.05	—0.052	—1.7
September,	78,457,000	63,367,000	36,893,000	803,000	797,000	1,500,000	-	27,040,000	—2,137,000	1.76	—0.049	—2.8
October,	100,058,000	52,397,000	37,977,000	855,000	761,000	1,500,000	5,536,000	-	—1,032,000	2.35	—0.024	—1.0
November,	101,383,000	72,823,000	37,017,000	810,000	887,000	7,450,000	-	5,187,000	12,417,000	3.64	0.285	7.8
December,	100,648,000	66,681,000	37,232,000	755,000	951,000	18,680,000	13,526,000	-	37,177,000	5.13	0.882	17.2
Total,	-	-	-	-	-	-	-	-	-	40.72	16.410	-
Av. for year,	92,126,000	74,368,000	36,645,000	820,000	1,293,000	32,338,000	5,257,000	-	58,595,000	-	-	40.3

[1] Not including 171,000 gallons per day drawn from the Wachusett Aqueduct for the supply of the Westborough State Hospital, which were not discharged into Sudbury Reservoir.

[2] Including quantities of water wasted from aqueduct.

TABLE No. 11. — *Cochituate System. — Statistics of Flow of Water, Storage and Rainfall in 1912.*

[Watershed of lake = 17.58 square miles.[1]]

MONTH.	GALLONS PER DAY.							Rainfall (Inches).	Rainfall collected (Inches).	Percentage of Rainfall collected.
	Water received from External Sources.[2]	Water discharged through Cochituate Aqueduct.	Water diverted from Watershed by Sewers, etc.	Water wasted at Outlet of Lake.	STORAGE. Gain.	STORAGE. Loss.	Total Yield of Watershed.			
January,	-	-	736,000	-	10,406,000	-	11,142,000	3.10	1.13	36.5
February,	-	6,279,000	417,000	-	13,559,000	-	20,255,000	2.51	1.92	76.6
March,	-	-	1,158,000	46,052,000	1,219,000	-	48,429,000	6.38	4.91	77.0
April,	-	-	1,776,000	29,910,000	2,687,000	-	34,373,000	4.16	3.38	81.1
May,	-	-	1,239,000	23,035,000	1,229,000	-	25,503,000	5.23	2.59	49.5
June,	-	6,210,000	483,000	2,713,000	-	4,666,000	4,740,000	0.47	0.46	99.0
July,	-	-	171,000	-	535,000	-	706,000	3.00	0.07	2.4
August,	-	8,726,000	177,000	-	-	7,561,000	1,342,000	2.26	0.14	6.0
September,	-	15,930,000	160,000	-	-	12,103,000	3,987,000	1.82	0.39	21.5
October,	174,000	9,419,000	71,000	-	-	4,487,000	4,829,000	2.99	0.49	16.4
November,	13,000	4,413,000	217,000	-	1,250,000	-	5,867,000	3.24	0.58	17.8
December,	-	-	316,000	-	10,510,000	-	10,826,000	4.96	1.10	22.1
Total,	-	-	-	-	-	-	-	40.12	17.16	-
Average for year,	16,000	4,211,000	577,000	8,526,000	1,026,000	-	14,324,000	-	-	42.8

[1] Not including the watersheds of Dudley and Dug ponds.

[2] From Framingham Reservoirs, Nos. 1, 2, and 3.

TABLE NO. 12. — *Elevations of Water Surfaces of Reservoirs above Boston City Base at the Beginning of Each Month.*

DATE.	Chestnut Hill Reservoir. Ordinary High Water =134.00.	Lake Cochituate. High Water =144.36.	Farm Pond. High Water =159.25.	Spot Pond. High Water =163.00.	Weston Reservoir. High Water =200.00.	FRAMINGHAM RESERVOIR. No. 1. Flash Boards 169.27.	FRAMINGHAM RESERVOIR. No. 2. Flash Boards 177.12.	FRAMINGHAM RESERVOIR. No. 3. Flash Boards 186.50.	Ashland Reservoir. Flash Boards 225.23.	Sudbury Reservoir. Flash Boards 259.97.	Hopkinton Reservoir. Flash Boards 305.00.	Whitehall Reservoir. Ordinary High Water =337.91.	Wachusett Reservoir. Ordinary High Water =395.00.
Jan. 1, 1912, .	133.83	140.21	156.95	162.79	199.98	167.76	177.29	184.00	208.51	256.97	286.66	336.13	382.30
Feb. 1, 1912, .	131.74	141.82	157.23	162.34	199.99	167.65	177.13	183.93	212.55	254.17	289.70	336.58	383.03
Mar. 1, 1912, .	133.99	143.70	157.53	162.61	200.12	167.88	176.14	183.97	217.37	256.08	294.46	336.94	382.65
April 1, 1912, .	133.86	143.86	158.08	162.94	200.09	168.24	176.50	183.80	224.82	255.08	304.57	337.21	390.20
May 1, 1912, .	133.88	144.20	159.40	162.85	199.94	167.94	177.42	183.93	225.55	257.04	305.02	337.54	394.62
June 1, 1912, .	134.14	144.36	159.23	163.21	200.01	167.92	177.37	186.67	225.15	260.13	304.97	337.73	395.29
July 1, 1912, .	133.66	143.77	158.48	163.00	200.01	169.26	177.00	183.13	225.20	258.39	304.82	337.41	394.41
Aug. 1, 1912, .	133.95	143.84	157.94	162.88	200.02	169.12	177.15	184.19	225.24	260.06	304.60	337.24	391.27
Sept. 1, 1912, .	133.66	142.76	157.51	162.78	200.00	169.00	177.07	183.38	225.13	257.97	304.39	337.09	389.73
Oct. 1, 1912, .	134.33	140.98	157.13	163.55	200.02	169.02	177.07	185.00	224.99	255.72	304.20	336.97	388.09
Nov. 1, 1912, .	131.30	140.28	158.74	161.59	200.03	168.85	176.57	184.90	224.28	256.18	304.00	336.98	385.91
Dec. 1, 1912, .	134.04	140.47	158.42	163.12	199.96	168.36	177.17	185.02	224.33	255.65	304.02	337.22	384.36
Jan. 1, 1913, .	133.96	142.05	158.48	163.09	200.00	167.98	176.22	184.95	224.54	256.54	304.37	337.76	383.79

TABLE NO. 13. — *Sources from which and Periods during which Water has been drawn for the Supply of the Metropolitan Water District.*

From Wachusett Reservoir into the Wachusett Aqueduct.

MONTH.	Number of Days during which Water was flowing.	ACTUAL TIME.		Million Gallons drawn.
		Hours.	Minutes.	
January,	27	275	28	2,073.9
February,	24	311	57	3,444.9
March,	9	91	36	729.5
April,	16	320	58	2,303.2
May,	31	705	-	4,121.2
June,	28	453	-	2,390.5
July,	27	404	5	4,672.3
August,	16	242	4	2,406.8
September,	23	306	31	2,359.0
October,	31	473	43	3,107.4
November,	29	516	20	3,046.8
December,	31	537	28	3,125.3
Totals,	292	4,638	10	33,780.8

Total actual time, 193.26 days.
Total quantity drawn, 33,780,800,000 gallons.

From Sudbury Reservoir through the Weston Aqueduct to Weston Reservoir.

MONTH.	Number of Days during which Water was flowing.	Actual Time (Hours).	Million Gallons drawn.
January,	31	744	1,131.7
February,	29	696	1,056.3
March,	31	744	1,109.1
April,	30	720	1,066.4
May,	31	744	1,131.7
June,	30	720	1,101.7
July,	31	744	1,136.6
August,	31	744	1,129.6
September,	30	720	1,106.8
October,	31	744	1,177.3
November,	30	720	1,110.5
December,	31	723	1,149.5
Totals,	366	8,763	13,407.2

Total actual time, 365.13 days.
Total quantity drawn, 13,407,200,000 gallons.

TABLE No. 13 — *Continued.*

From Framingham Reservoir No. 2 through the Sudbury Aqueduct to Chestnut Hill Reservoir.

MONTH.	Number of Days during which Water was flowing.	Actual Time (Hours).	Million Gallons drawn.
January,	31	744	310.0
February,	29	694	289.2
March,	18	412	171.7
April,	-	-	-
May,	-	-	-
June,	-	-	-
July,	-	-	-
August,	-	-	-
September,	-	-	-
October,	-	-	-
November,	-	-	-
December,	-	-	-
Totals,	78	1,850	770.9

Total actual time, 77.08 days.
Total quantity drawn, 770,900,000 gallons.

From Framingham Reservoir No. 3 through the Sudbury Aqueduct to Chestnut Hill Reservoir.

MONTH.	Number of Days during which Water was flowing.	Actual Time (Hours).	Million Gallons drawn.
January,	31	744	2,584.7
February,	29	696	2,533.5
March,	31	744	2,244.9
April,	30	696	2,110.8
May,	31	744	2,270.0
June,	30	716.5	2,267.4
July,	31	744	2,545.4
August,	31	724	2,105.2
September,	29	670.5	1,881.3
October,	20	441	1,599.3
November,	29	692.5	2,184.3
December,	31	744	2,067.1
Totals,	353	8,356.5	26,393.9

Total actual time, 348.19 days.
Total quantity drawn, 26,393,900,000 gallons.

TABLE NO. 13 — *Concluded.*

From Lake Cochituate through the Cochituate Aqueduct to Chestnut Hill Reservoir.

MONTH.	Number of Days during which Water was flowing.	Actual Time (Hours).	Million Gallons drawn.
January,	-	-	-
February,	15	333.75	182.1
March,	-	-	-
April,	-	-	-
May,	-	-	-
June,	16	384	186.3
July,	-	-	-
August,	17	383	270.5
September,	30	718	477.9
October,	14	332	292.0
November,	8	149	132.4
December,	-	-	-
Totals,	100	2,299	1,541.2

Total actual time, 95.82 days.
Total quantity drawn, 1,541,200,000 gallons.

TABLE NO. 14. — *Average Daily Quantity of Water flowing through Aqueducts in 1912 by Months.*[1]

MONTH.	Wachusett Aqueduct into Sudbury Reservoir (Gallons).	Weston Aqueduct into Metropolitan District (Gallons).	Sudbury Aqueduct into Chestnut Hill Reservoir (Gallons).	Cochituate Aqueduct into Chestnut Hill Reservoir (Gallons).
January,	66,748,000	36,507,000	93,377,000	-
February,	118,634,000	36,424,000	97,335,000	6,279,000
March,	23,365,000	35,777,000	77,955,000	-
April,	76,607,000	35,547,000	70,360,000	-
May,	132,774,000	36,506,000	73,226,000	-
June,	79,507,000	36,723,000	75,580,000	6,210,000
July,	150,529,000	36,664,000	82,110,000	-
August,	77,461,000	36,439,000	67,910,000	8,726,000
September,	78,457,000	36,893,000	62,710,000	15,930,000
October,	100,058,000	37,977,000	51,590,000	9,419,000
November,	101,383,000	37,017,000	72,810,000	4,413,000
December,	100,648,000	37,081,000	66,681,000	-
Average,	92,126,000	36,632,000	74,221,000	4,211,000

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[1] Not including quantities wasted while cleaning and repairing aqueducts.

TABLE No. 15. — *Statement of Operation of Engines Nos. 1 and 2 at Chestnut Hill Pumping Station No. 1 for the Year 1912.*

[3 per cent. allowed for slip.]

MONTH.	ENGINE No. 1.			ENGINE No. 2.			Total Quantity pumped (Million Gallons).	Coal consumed in Pumping (Pounds).	Coal used in Banking (Pounds).	Ashes and Clinker from Coal used in Pumping (Pounds).	Per cent. of Ashes and Clinker.	Gallons pumped per Pound of Coal used in Pumping.	AVERAGE LIFT (FEET).		Duty in Foot-pounds per 100 Pounds of Coal used in Pumping; corrected for Slip.	Duty in Foot-pounds per 100 Pounds of Coal used in Pumping, on Basis of Plunger Displacement.
	Total Pumping Time.		Quantity pumped, corrected for Slip (Million Gallons).	Total Pumping Time.		Quantity pumped, corrected for Slip (Million Gallons).							Engine No. 1.	Engine No. 2.		
	Hrs.	Min.		Hrs.	Min.											
January,	342	05	118.43	47	50	15.69	134.12	219,070	35,640	25,015	11.4	612.22	133.57	134.46	68,170,000	70,290,000
February,	226	40	77.07	-	-	-	77.07	126,820	54,245	14,185	11.2	607.71	136.13	-	68,910,000	71,050,000
March,	222	25	75.01	-	-	-	75.01	112,450	40,430	7,915	7.0	667.05	133.77	-	74,330,000	76,640,000
April,	228	05	76.78	-	-	-	76.78	106,585	12,165	6,615	6.2	720.36	133.46	-	80,080,000	82,570,000
May,	289	10	96.91	7	45	2.68	99.59	138,695	-	15,575	11.2	718.05	133.32	135.80	79,780,000	82,260,000
June,	159	15	54.41	-	-	-	54.41	72,620	-	7,765	10.7	749.24	133.36	-	83,230,000	85,820,000
July,	184	00	65.07	-	-	-	65.07	86,900	-	10,180	11.7	748.79	134.59	-	83,950,000	86,560,000
August,	174	15	61.35	-	-	-	61.35	81,730	-	7,870	9.6	750.64	134.62	-	84,180,000	86,800,000
September,	354	10	121.89	-	-	-	121.89	164,710	-	15,200	9.2	740.03	132.84	-	81,890,000	84,440,000
October,	215	50	72.68	-	-	-	72.68	101,145	15,245	11,905	11.9	718.57	134.20	-	80,330,000	82,830,000
November,	140	50	48.46	-	-	-	48.46	78,150	32,160	9,060	11.6	620.09	134.84	-	69,650,000	71,820,000
December,	166	25	56.12	-	-	-	56.12	92,845	50,080	8,365	9.0	604.45	134.17	-	67,560,000	69,660,000
Total,	2,703	10	924.18	55	35	18.37	942.55	1,381,720	239,965	139,650	-	-	-	-	-	-
Average,	-	-	-	-	-	-	-	-	-	-	10.1	682.16	133.95	134.66	76,120,000	78,490,000

TABLE No. 16. — *Statement of Operation of Engine No. 3 at Chestnut Hill Pumping Station No. 1 for the Year 1912.*

[4.4 per cent. allowed for slip.]

MONTH.	Total Pumping Time. Hrs.	Total Pumping Time. Min.	Quantity pumped, corrected for Slip (Million Gallons).	Amount of Coal consumed (Pounds).	Amount of Ashes and Clinker (Pounds).	Per Cent. of Ashes and Clinker.	Gallons pumped per Pound of Coal, no Deduction for Heating or Lighting.	Average Lift (Feet).	Duty in Foot-pounds per 100 Pounds of Coal, no Deduction for Heating or Lighting; corrected for Slip.	Duty in Foot-pounds per 100 Pounds of Coal, on Basis of Plunger Displacement, no Deduction for Heating or Lighting.
January, ...	-	-	-	-	-	-	-	-	-	-
February, ...	-	-	-	-	-	-	-	-	-	-
March, ...	-	-	-	-	-	-	-	-	-	-
April, ...	25	55	22.33	21,735	1,810	8.3	1,027.38	118.09	101,060,000	105,700,000
May, ...	-	-	-	-	-	-	-	-	-	-
June, ...	-	-	-	-	-	-	-	-	-	-
July, ...	-	-	-	-	-	-	-	-	-	-
August, ...	-	-	-	-	-	-	-	-	-	-
September, ...	-	-	-	-	-	-	-	-	-	-
October, ...	-	-	-	-	-	-	-	-	-	-
November, ...	-	-	-	-	-	-	-	-	-	-
December, ...	-	-	-	-	-	-	-	-	-	-
Total, ...	25	55	22.33	21,735	1,810	8.3	1,027.38	118.09	101,060,000	105,700,000
Average, ...	-	-	-	-	-	-	-	-	-	-

TABLE No. 17. — *Statement of Operation of Engine No. 4 at Chestnut Hill Pumping Station No. 1 for the Year 1912.*

[2 per cent. allowed for slip.]

MONTH.	Total Pumping Time.		Quantity pumped, corrected for Slip (Million Gallons).	Coal consumed in Pumping (Pounds).	Coal used in Banking (Pounds).	Ashes and Clinker from Coal used in Pumping (Pounds).	Per Cent. of Ashes and Clinker.	Gallons pumped per Pound of Coal used in Pumping.	Average Lift (Feet).	Duty in Foot-pounds per 100 Pounds of Coal used in Pumping, corrected for Slip.	Duty in Foot-pounds per 100 Pounds of Coal used in Pumping, on Basis of Plunger Displacement.	SUMMARY OF ENGINES NOS. 1, 2, 3 AND 4. Total Quantity pumped, corrected for Slip (Million Gallons).	SUMMARY OF ENGINES NOS. 1, 2, 3 AND 4. Daily Average Quantity pumped (Million Gallons).
	Hrs.	Min.											
January,	599	45	774.63	546,795	18,210	61,910	11.3	1,416.67	120.76	142,510,000	145,370,000	908.75	29.315
February,	129	00	166.62	119,685	70,080	14,155	11.8	1,392.15	123.42	143,130,000	146,010,000	243.69	8.403
March,	408	35	521.52	383,225	26,820	38,265	10.0	1,360.87	120.93	137,090,000	139,850,000	596.53	19.243
April,	493	30	630.44	458,065	29,010	50,005	10.9	1,376.31	119.44	136,930,000	139,680,000	729.55	24.318
May,	741	25	954.60	690,155	-	76,475	11.1	1,383.17	119.46	137,640,000	140,410,000	1,054.19	34.006
June,	99	15	128.02	89,015	50,985	8,330	9.4	1,438.18	119.91	143,650,000	146,540,000	182.43	6.081
July,	-	-	-	-	53,925	-	-	-	-	-	-	65.07	2.099
August,	212	35	272.60	199,722	55,528	20,540	10.3	1,364.90	126.67	144,020,000	146,910,000	333.95	10.773
September,	699	05	894.30	619,150	-	60,595	9.8	1,444.40	123.36	148,420,000	151,400,000	1,016.19	33.873
October,	358	30	460.77	313,675	53,595	31,990	10.2	1,468.94	119.69	146,460,000	149,400,000	533.45	17.208
November,	246	00	316.69	214,620	26,370	16,980	7.9	1,475.58	120.18	147,720,000	150,690,000	365.15	12.172
December,	475	35	598.86	400,422	14,020	34,925	8.7	1,495.57	119.69	149,110,000	152,110,000	654.98	21.128
Total,	4,463	15	5,719.05	4,034,529	398,543	414,170	-	-	-	-	-	6,683.93	-
Average,	-	-	-	-	-	-	10.3	1,417.53	120.93	142,790,000	145,660,000	-	18.262

TABLE No. 18. — *Statement of Operation of Engines Nos. 5, 6 and 7, at Chestnut Hill Pumping Station No. 2 for the Year 1912.*

[2 per cent. allowed for slip.]

MONTH.	ENGINE No. 5. Total Pumping Time.		ENGINE No. 5. Quantity pumped, corrected for Slip (Million Gallons).	ENGINE No. 6. Total Pumping Time.		ENGINE No. 6. Quantity pumped, corrected for Slip (Million Gallons).	ENGINE No. 7. Total Pumping Time.		ENGINE No. 7. Quantity pumped, corrected for Slip (Million Gallons).	Total Quantity pumped (Million Gallons).	Daily Average Quantity pumped (Million Gallons).	Total Coal consumed (Pounds).	Per Cent. of Ashes and Clinker.	Gallons pumped per Pound of Coal, no Deduction for Heating or Lighting.	AVERAGE LIFT (FEET). Engine No. 5.	AVERAGE LIFT (FEET). Engine No. 6.	AVERAGE LIFT (FEET). Engine No. 7.	Duty in Foot-pounds per 100 Pounds of Coal, no Deduction for Heating or Lighting; corrected for Slip.	Duty in Foot-pounds per 100 Pounds of Coal, on Basis of Plunger Displacement; no Deduction for Heating or Lighting.
	Hrs.	Min.		Hrs.	Min.		Hrs.	Min.											
January,	453	30	540.84	744	00	933.95	356	45	393.33	1,868.12	60.262	715,065	10.6	2,612.52	55.98	51.73	33.30	106,810,000	109,000,000
February,	696	00	800.38	696	00	801.77	181	10	232.83	1,834.98	63.275	716,150	11.0	2,562.28	55.56	55.45	34.77	112,850,000	115,160,000
March,	383	05	402.55	695	35	798.77	280	25	260.03	1,461.35	47.140	532,425	10.8	2,744.71	49.13	45.78	32.16	101,240,000	103,320,000
April,	450	00	495.99	546	35	614.67	125	00	101.79	1,212.45	40.415	441,750	9.5	2,744.65	42.98	42.63	32.11	95,770,000	97,730,000
May,	375	50	448.27	485	30	576.12	295	50	241.19	1,265.58	40.825	451,380	10.4	2,803.80	45.21	44.26	31.97	98,690,000	100,710,000
June,	477	45	524.43	642	50	746.36	98	35	79.60	1,350.39	45.013	478,820	9.5	2,820.25	49.84	48.54	35.27	113,380,000	115,700,000
July,	612	35	664.85	511	25	561.10	189	30	181.82	1,407.77	45.412	509,855	9.0	2,761.12	48.46	48.85	38.04	108,720,000	110,950,000
August,	621	40	708.61	117	00	136.13	447	25	485.86	1,330.60	42.923	474,200	8.6	2,805.99	44.02	43.47	45.88	104,350,000	106,490,000
September,	128	10	137.75	663	15	735.55	401	05	429.68	1,302.98	43.433	532,485	10.0	2,446.98	55.46	45.75	46.12	95,600,000	97,560,000
October,	472	40	505.91	420	30	441.07	72	55	80.25	1,027.23	33.136	420,875	9.0	2,440.70	46.01	44.33	39.24	91,440,000	93,310,000
November,	580	45	631.82	344	25	360.79	342	15	329.22	1,321.83	44.061	504,440	10.0	2,620.39	50.07	48.04	38.47	101,780,000	103,870,000
December,	63	35	76.16	689	20	803.54	336	00	298.45	1,178.15	38.005	442,818	10.7	2,660.57	42.44	39.76	32.12	84,210,000	85,940,000
Total,	5,315	35	5,937.56	6,556	25	7,509.82	3,126	55	3,114.05	16,561.43	-	6,220,263	-	-	-	-	-	-	-
Average,	-	-	-	-	-	-	-	-	-	-	45.250	-	10.0	2,662.50	49.08	47.05	37.82	102,110,000	104,200,000

TABLE No. 19. — *Statement of Operation of Engine No. 12 at Chestnut Hill Pumping Station No. 2 for the Year 1912.*

[2 per cent. allowed for slip.]

MONTH.	Total Pumping Time.		Quantity pumped, corrected for Slip (Million Gallons).	Coal consumed in Pumping (Pounds).	Coal used in Banking (Pounds).	Ashes and Clinker from Coal used in Pumping (Pounds).	Per Cent. of Ashes and Clinker.	Gallons pumped per Pound of Coal used in Pumping.	Average Lift (Feet).	Duty in Foot-pounds per 100 Pounds of Coal used in Pumping, corrected for Slip.	Duty in Foot-pounds per 100 Pounds of Coal used in Pumping, on Basis of Plunger Displacement.
	Hrs.	Min.									
January,	151	40	203.77	142,485	26,565	20,640	14.4	1,420.15	120.56	142,620,000	145,520,000
February,	575	55	888.71	581,580	12,115	66,550	11.4	1,528.10	125.40	159,620,000	162,860,000
March,	339	40	496.49	334,900	17,770	38,870	11.6	1,482.50	121.11	149,560,000	152,600,000
April,	195	15	263.20	176,475	11,510	21,575	12.2	1,492.00	120.54	149,810,000	152,850,000
May,	-	-	-	-	8,985	-	-	-	-	-	-
June,	620	35	899.30	577,190	2,900	62,075	10.8	1,558.07	124.40	161,460,000	164,740,000
July,	742	40	1,065.63	700,705	-	75,495	10.8	1,520.80	126.30	160,000,000	163,250,000
August,	531	05	709.91	468,125	10,260	49,450	10.6	1,516.50	127.03	160,470,000	163,730,000
September,	21	15	29.45	19,850	6,820	1,900	9.6	1,483.63	119.99	148,290,000	151,300,000
October,	384	00	528.30	355,607	13,690	37,355	10.5	1,485.63	121.37	150,200,000	153,250,000
November,	473	30	607.15	468,260	4,400	53,115	11.3	1,296.61	119.59	129,170,000	131,790,000
December,	271	15	343.31	242,915	2,390	32,425	13.3	1,413.29	120.05	141,330,000	144,200,000
Total,	4,306	50	6,035.32	4,069,092	117,405	459,450	-	-	-	-	-
Average,	-	-	-	-	-	-	11.3	1,483.21	123.61	152,720,000	155,820,000

TABLE No. 20. — *Statement of Operation of Engine No. 8 at Spot Pond Pumping Station for the Year 1912.*

[2 per cent. allowed for slip.]

MONTH.	Total Pumping Time.		Quantity pumped, corrected for Slip (Million Gallons).	Coal consumed (Pounds).	Ashes and Clinker (Pounds).	Per Cent. of Ashes and Clinker.	Gallons pumped per Pound of Coal, no Deduction for Heating or Lighting.	Average Lift (Feet).	Duty in Foot-pounds per 100 Pounds of Coal, no Deduction for Heating or Lighting; corrected for Slip.	Duty in Foot-pounds per 100 Pounds of Coal, on Basis of Plunger Displacement, no Deduction for Heating or Lighting.
	Hrs.	Min.								
January,	15	30	7.15	8,652	1,335	15.4	826.40	125.86	86,640,000	88,420,000
February,	139	00	61.99	65,179	6,912	10.6	951.07	120.75	95,660,000	97,630,000
March,	591	05	254.42	262,803	20,043	7.6	968.10	120.00	96,770,000	98,760,000
April,	480	45	202.63	220,106	23,703	10.8	920.60	119.80	91,870,000	93,760,000
May,	-	-	-	-	-	-	-	-	-	-
June,	-	-	-	-	-	-	-	-	-	-
July,	14	00	5.96	6,070	705	11.6	981.88	121.24	99,160,000	101,200,000
August,	-	-	-	-	-	-	-	-	-	-
September,	-	-	-	-	-	-	-	-	-	-
October,	14	00	5.92	5,975	565	9.5	990.79	121.41	100,200,000	102,260,000
November,	-	-	-	-	-	-	-	-	-	-
December,	-	-	-	-	-	-	-	-	-	-
Total,	1,254	20	538.07	568,785	53,263	-	-	-	-	-
Average,	-	-	-	-	-	9.4	946.00	120.12	94,660,000	96,610,000

TABLE No. 21. — *Statement of Operation of Engine No. 9 at Spot Pond Pumping Station for the Year 1912.*

[2 per cent. allowed for slip.]

MONTH.	Total Pumping Time.		Quantity pumped corrected for Slip (Million Gallons).	Coal consumed (Pounds).	Ashes and Clinker (Pounds).	Per Cent. of Ashes and Clinker.	Gallons pumped per Pound of Coal, no Deduction for Heating or Lighting.	Average Lift (Feet).	Duty in Foot-pounds per 100 Pounds of Coal, no Deduction for Heating or Lighting; corrected for Slip.	Duty in Foot-pounds per 100 Pounds of Coal on Basis of Plunger Displacement, no Deduction for Heating or Lighting.	SUMMARY OF ENGINES NOS. 8 AND 9. Total Quantity pumped, corrected for Slip (Million Gallons).	SUMMARY OF ENGINES NOS. 8 AND 9. Daily Average Quantity pumped (Million Gallons).
	Hrs.	Min.										
January,	308	15	254.75	229,324	28,718	12.5	1,110.87	133.81	123,820,000	126,330,000	261.90	8.448
February,	237	45	196.16	166,497	18,693	11.2	1,178.16	127.71	125,340,000	127,880,000	258.15	8.902
March,	-	-	-	-	-	-	-	-	-	-	254.42	8.207
April,	36	00	29.32	28,430	3,174	11.2	1,031.30	130.83	112,390,000	114,670,000	231.95	7.732
May,	290	50	238.88	207,182	24,565	11.9	1,153.00	128.83	123,730,000	126,240,000	238.88	7.706
June,	330	55	274.64	228,044	28,485	12.5	1,204.33	129.74	130,160,000	132,800,000	274.64	9.155
July,	341	10	286.36	224,228	25,924	11.6	1,277.09	129.39	137,650,000	140,440,000	292.32	9.430
August,	299	40	250.24	203,925	20,555	10.1	1,227.12	128.94	131,800,000	134,480,000	250.24	8.072
September,	279	15	231.24	186,400	18,608	10.0	1,240.56	128.70	133,000,000	135,700,000	231.24	7.708
October,	272	40	224.85	183,980	17,701	9.6	1,222.14	130.03	132,380,000	135,070,000	230.77	7.444
November,	247	00	205.69	171,758	15,397	9.0	1,197.56	129.43	129,120,000	131,740,000	205.69	6.856
December,	251	05	208.72	179,082	19,934	11.1	1,165.50	128.21	124,470,000	127,000,000	208.72	6.733
Total,	2,894	35	2,400.85	2,008,850	221,754	-	-	-	-	-	2,938.92	-
Average,	-	-	-	-	-	11.0	1,195.14	129.57	128,990,000	131,610,000	-	8.030

TABLE NO. 22. — *Statement of Operation of Engine No. 10 at Arlington Pumping Station for the Year 1912.*

[2 per cent. allowed for slip.]

MONTH.	Total Pumping Time.		Quantity pumped, corrected for Slip (Million Gallons).	Coal consumed (Pounds).	Ashes and Clinker (Pounds).	Per Cent. of Ashes and Clinker.	Gallons pumped per Pound of Coal, no Deduction for Heating or Lighting.	Average Lift (Feet).	Duty in Foot-pounds per 100 Pounds of Coal, no deduction for Heating or Lighting; corrected for Slip.	Duty in Foot-pounds per 100 Pounds of Coal, on Basis of Plunger Displacement, no Deduction for Heating or Lighting.
	Hrs.	Min.								
January,	590	30	24.27	89,695	9,826	11.0	270.58	283.65	63,930,000	65,040,000
February,	592	15	23.68	85,810	9,220	10.7	275.96	284.38	65,370,000	66,500,000
March,	600	00	24.76	84,540	7,198	8.5	292.88	284.81	69,480,000	70,680,000
April,	633	00	25.53	85,175	7,058	8.3	299.74	284.78	71,100,000	72,330,000
May,	675	30	29.54	99,850	10,602	10.6	295.84	286.21	70,530,000	71,750,000
June,	639	00	33.10	108,465	12,946	11.9	305.17	290.54	73,860,000	75,140,000
July,	696	00	37.86	120,385	15,113	12.6	314.49	291.23	76,290,000	77,610,000
August,	659	45	31.42	105,460	11,332	10.7	297.93	286.20	71,030,000	72,260,000
September,	478	00	20.88	76,345	9,904	13.0	273.50	284.71	64,860,000	65,980,000
October,	540	00	22.78	83,710	9,926	11.9	272.13	284.72	64,540,000	65,660,000
November,	390	30	16.04	66,815	7,191	10.8	240.07	284.41	56,880,000	57,860,000
December,	490	15	20.50	80,090	7,830	9.8	255.96	284.36	60,630,000	61,680,000
Total,	6,984	45	310.36	1,086,340	118,146	–	–	–	–	–
Average,	–	–	–	–	–	10.9	285.69	286.29	68,130,000	69,310,000

TABLE No. 23. — *Statement of Operation of Engine No. 11 at Arlington Pumping Station for the Year 1912.*

[4 per cent. allowed for slip.]

MONTH.	Total Pumping Time.		Quantity pumped, corrected for Slip (Million Gallons).	Coal consumed (Pounds).	Ashes and Clinker (Pounds).	Per Cent. of Ashes and Clinker.	Gallons pumped per Pound of Coal, no Deduction for Heating or Lighting.	Average Lift (Feet).	Duty in Foot-pounds per 100 Pounds of Coal, no Deduction for Heating or Lighting; corrected for Slip.	Duty in Foot-pounds per 100 Pounds of Coal, on Basis of Plunger Displacement, no Deduction for Heating or Lighting.	SUMMARY OF ENGINES NOS. 10 AND 11. Total Quantity pumped, corrected for Slip (Million Gallons).	SUMMARY OF ENGINES NOS. 10 AND 11. Daily Average Quantity pumped (Million Gallons).
	Hrs.	Min.										
January,	-	-	-	-	-	-	-	-	-	-	24.27	.783
February,	-	-	-	-	-	-	-	-	-	-	23.68	.817
March,	45	15	1.66	10,240	933	9.1	162.11	283.25	38,250,000	40,030,000	26.42	.852
April,	28	30	1.09	6,540	395	6.0	166.67	283.41	39,350,000	41,180,000	26.62	.887
May,	-	-	-	-	-	-	-	-	-	-	29.54	.953
June,	56	00	2.30	14,220	1,545	10.9	161.74	296.95	40,010,000	41,870,000	35.40	1.180
July,	53	15	1.80	11,745	1,023	8.7	153.28	309.15	39,470,000	41,310,000	39.66	1.279
August,	-	-	-	-	-	-	-	-	-	-	31.42	1.014
September,	-	-	-	-	-	-	-	-	-	-	20.88	.696
October,	-	-	-	-	-	-	-	-	-	-	22.78	.735
November,	120	00	3.38	22,655	2,158	9.5	149.19	282.83	35,150,000	36,780,000	19.42	.647
December,	-	-	-	-	-	-	-	-	-	-	20.50	.661
Total,	303	00	10.23	65,400	6,054	-	-	-	-	-	320.59	-
Average,	-	-	-	-	-	9.3	156.42	290.76	37,890,000	39,650,000	-	.876

TABLE NO. 24. — (*Meter Basis.*) *Average Daily Consumption of Water during the Year 1912, in the Cities and Towns supplied by the Metropolitan Water Works, including Boston, Somerville, Chelsea, Malden, Everett, Quincy, Medford, Melrose, Revere, Watertown, Arlington, Lexington, Milton, Stoneham, Winthrop, Swampscott, Belmont and Nahant. (For Consumption of Water in Whole Metropolitan Water District, see Table No. 28.)*

MONTH.	Average Daily Consumption (Gallons).	Estimated Population.	Consumption per Inhabitant (Gallons).
January,	136,635,300	1,072,760	127
February,	137,390,800	1,074,790	128
March,	118,574,300	1,076,820	110
April,	111,699,100	1,078,840	104
May,	112,689,400	1,082,570	104
June,	117,470,900	1,087,610	108
July,	119,617,900	1,092,080	110
August,	112,578,700	1,091,780	103
September,	110,816,500	1,091,400	102
October,	108,166,000	1,091,430	99
November,	104,026,400	1,093,040	95
December,	105,793,300	1,095,070	97
For the year,	116,230,700	1,086,690	107

In addition to the above quantities, Wakefield was supplied with 13,327,000 gallons, equivalent to a daily average rate of 36,400 gallons, the United States Government Reservation on Peddocks Island with 41,698,700 gallons, equivalent to a daily average rate of 113,900 gallons, and a part of Saugus with 6,411,400 gallons, equivalent to a daily average rate of 17,500 gallons.

The above table includes the Hyde Park district.

Included in above quantities is 34,971,000 gallons supplied to the Hyde Park district from local sources which were discontinued February 5th.

TABLE NO. 25. — (*Meter Basis.*) *Average Daily Consumption of Water in Gallons, from the Low-service System in 1912.*

MONTH.	SOUTHERN LOW SERVICE.	NORTHERN LOW SERVICE.	Total Low-service Consumption.
	Boston, excluding East Boston and Charlestown.	Portions of Charlestown, Somerville, Chelsea, Everett, Malden, Medford, East Boston and Arlington.	
January,	60,398,100	31,177,500	91,575,600
February,	60,011,700	31,005,900	91,017,600
March,	50,862,900	25,844,600	76,707,500
April,	46,980,600	24,156,900	71,137,500
May,	47,618,400	22,715,600	70,334,000
June,	47,674,700	23,648,900	71,323,600
July,	48,787,800	23,914,900	72,702,700
August,	47,480,500	22,615,600	70,096,100
September,	46,636,200	22,095,300	68,731,500
October,	46,578,700	21,161,200	67,739,900
November,	46,099,900	20,370,700	66,470,600
December,	46,991,100	20,728,400	67,719,500
For the year,	49,651,100	24,099,000	73,750,100

TABLE No. 26. — (*Meter Basis.*) *Average Daily Consumption of Water, in Gallons, from the High-service and Extra High-service Systems in 1912.*

MONTH.	SOUTHERN HIGH SERVICE.	SOUTHERN EXTRA HIGH SERVICE.	NORTHERN HIGH SERVICE.	NORTHERN EXTRA HIGH SERVICE.
	Quincy, Watertown, and Portions of Boston, Belmont and Milton.	Portions of Boston and Milton.	Revere, Winthrop, Swampscott, Nahant, Stoneham, Melrose, and Portions of Boston, Chelsea, Everett, Malden, Medford and Somerville.	Lexington and Portions of Arlington and Belmont.
January,	35,458,100	739,300	8,079,500	782,800
February,	35,849,800	777,100	8,929,700	816,600
March,	32,170,000	756,700	8,087,800	852,300
April,	31,764,100	778,500	7,131,600	887,400
May,	33,105,400	846,700	7,450,400	952,900
June,	34,900,000	987,700	9,079,600	1,180,000
July,	35,185,100	1,023,700	9,427,000	1,279,400
August,	32,665,100	797,200	8,006,800	1,013,500
September,	33,034,500	810,500	7,543,900	696,100
October,	31,737,300	881,900	7,072,000	734,900
November,	29,442,700	829,600	6,636,000	647,500
December,	30,085,700	817,100	6,509,700	661,300
For the year,	32,941,100 [1]	837,400	7,826,100 [2]	876,000

In addition to the above [1] the United States Government Reservation on Peddocks Island was supplied with a daily average rate of 113,900 gallons, and [2] part of Saugus with a daily average rate of 17,500 gallons, and Wakefield with a daily average rate of 36,400 gallons.

The above table includes Hyde Park district.

Included in above quantities is 34,971,000 gallons supplied to Hyde Park district from local sources which were discontinued February 5th.

TABLE NO. 27. — *Average Daily Consumption of Water in Cities and Towns supplied from Metropolitan Works, as measured by Venturi Meters in 1912.*

City or town,	BOSTON.[1]		SOMERVILLE.		MALDEN.		CHELSEA.		EVERETT.		QUINCY.		MEDFORD.	
Population supplied,	**718,900.**		**81,080.**		**46,840.**		**34,720.**		**36,110.**		**34,640.**		**24,880.**	
MONTH.	GALLONS.		GALLONS.		GALLONS.		GALLONS.		GALLONS.		GALLONS.		GALLONS.	
	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.
January,	108,660,000	153	7,450,500	93	2,293,100	50	3,392,700	99	3,530,600	99	2,754,400	81	1,158,800	47
February,	107,955,700	151	7,676,200	96	2,358,300	51	3,323,200	97	3,478,000	98	2,941,300	86	1,285,400	52
March,	91,743,200	128	6,526,200	81	2,438,300	52	3,002,400	87	2,986,900	84	2,885,500	84	1,289,000	52
April,	87,041,300	122	5,887,100	73	2,122,800	46	2,787,100	81	2,527,700	71	3,038,500	88	1,146,200	46
May,	87,359,100	122	6,143,700	76	2,145,000	46	2,776,400	80	2,592,300	72	3,054,300	89	1,154,400	47
June,	88,442,200	123	6,685,000	83	2,339,900	50	2,911,300	84	2,802,400	78	3,440,400	100	1,367,400	55
July,	90,083,600	125	6,549,300	81	2,334,800	50	2,987,300	86	2,769,800	77	3,415,200	99	1,435,300	58
August,	86,561,500	120	6,093,700	75	2,126,000	45	2,917,300	84	2,466,600	68	3,082,700	89	1,187,500	48
September,	85,663,100	119	6,107,700	75	2,165,000	46	2,888,000	83	2,383,200	66	3,053,300	88	1,231,800	49
October,	83,865,800	116	6,077,800	75	2,161,600	46	2,791,500	80	2,378,700	65	2,937,500	84	1,143,600	46
November,	80,753,400	112	5,949,200	73	2,091,700	44	2,714,100	77	2,268,800	62	2,970,000	85	1,133,200	45
December,	82,888,700	114	6,028,700	74	2,141,200	45	2,744,900	78	2,331,300	64	2,476,500	71	1,146,000	45
For the year,	90,037,500	125	6,427,500	79	2,226,300	48	2,935,500	85	2,707,800	75	3,003,100	87	1,222,900	49

[1] Includes Hyde Park district.

TABLE NO. 27. — *Average Daily Consumption of Water in Cities and Towns, etc.* — Continued.

City or town,	MELROSE.		REVERE.		WATERTOWN.		ARLINGTON.		MILTON.		WINTHROP.	
Population supplied,	**16,350.**		**19,900.**		**13,700.**		**12,120.**		**8,300.**		**11,050.**	
	GALLONS.		GALLONS.		GALLONS.		GALLONS.		GALLONS.		GALLONS.	
MONTH.	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.
January,	1,053,600	65	1,872,900	96	913,000	68	973,100	82	309,800	38	607,300	56
February,	1,354,700	83	1,994,600	101	997,800	74	1,076,500	90	323,600	39	778,200	71
March,	1,252,700	77	1,619,300	82	950,200	70	1,097,600	93	308,500	37	657,000	60
April,	1,147,800	71	1,321,700	67	882,500	65	1,067,200	89	357,400	43	650,300	59
May,	1,199,900	74	1,366,000	69	882,800	65	1,075,100	89	402,000	49	691,100	63
June,	1,376,900	84	1,598,100	80	1,035,100	76	1,461,900	121	432,600	52	865,800	79
July,	1,288,000	79	1,695,000	85	1,076,300	79	1,499,100	124	389,900	47	956,600	87
August,	1,041,100	64	1,601,800	80	862,600	63	1,140,100	94	324,400	39	883,100	80
September,	1,016,200	62	1,401,900	70	912,600	66	906,700	74	339,800	41	732,900	66
October,	938,100	57	1,245,200	62	926,900	67	959,500	79	350,000	42	650,400	58
November,	985,500	60	1,067,600	53	826,500	60	807,100	66	305,000	36	587,400	53
December,	945,500	57	1,173,700	58	804,400	58	839,500	68	277,400	33	551,100	49
For the year,	1,132,100	69	1,495,400	75	922,300	67	1,075,500	89	343,300	41	717,400	65

TABLE No. 27. — *Average Daily Consumption of Water in Cities and Towns, etc.* — Concluded.

City or town,	STONEHAM.		BELMONT.		LEXINGTON.		NAHANT.		SWAMPSCOTT.		METROPOLITAN DISTRICT.	
Population supplied,	**7,600.**		**6,080.**		**4,740.**[1]		**2,290.**[2]		**7,310.**[2]		**1,086,690.**	
MONTH.	GALLONS.		GALLONS.		GALLONS.		GALLONS.		GALLONS.		GALLONS.	
	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.	Per Day.	Per Capita.
January,	523,800	70	349,100	59	327,600	70	58,100	45	406,300	63	136,635,300	127
February,	586,100	78	352,900	59	348,900	75	88,500	69	470,900	73	137,390,800	128
March,	634,300	84	361,700	60	369,200	79	83,900	65	368,400	57	118,574,300	110
April,	535,400	71	402,200	67	374,000	80	85,600	66	324,300	50	111,699,100	104
May,	554,600	73	406,900	67	394,100	83	114,500	60	377,200	50	112,689,400	104
June,	680,800	90	639,200	105	478,900	101	321,100	85	591,900	68	117,470,900	108
July,	866,800	114	653,300	107	507,300	107	406,900	77	703,400	72	119,617,900	110
August,	603,000	79	439,000	72	351,600	74	307,900	76	588,800	68	112,578,700	103
September,	583,300	76	442,100	72	316,100	66	203,300	71	469,500	63	110,816,500	102
October,	571,100	75	422,600	69	273,900	57	109,400	63	362,400	55	108,166,000	99
November,	500,600	65	386,100	63	269,300	56	64,400	48	346,500	53	104,026,400	95
December,	446,800	58	358,400	58	270,700	56	58,400	44	310,100	47	105,793,300	97
For the year,	590,700	78	434,500	71	356,800	75	158,800	69	443,300	61	116,230,700	107

[1] Allowance made for district not supplied.

[2] Allowance for summer population.

Included in above quantities is 34,971,000 gallons supplied to Hyde Park district from local sources which were discontinued February 5.

TABLE No. 28. — (*Pump Basis.*) *Consumption of Water in the Metropolitan Water District, as constituted in the Year 1912, and a Small Section of the Town of Saugus, from 1893 to 1912.*

[Gallons per day.]

MONTH.	1893.	1894.	1895.	1896.	1897.
January,	75,209,000	67,506,000	68,925,000	82,946,000	85,366,000
February,	71,900,000	68,944,000	80,375,000	87,021,000	83,967,000
March,	67,638,000	62,710,000	69,543,000	86,111,000	82,751,000
April,	62,309,000	57,715,000	62,909,000	77,529,000	79,914,000
May,	61,025,000	60,676,000	65,194,000	73,402,000	76,772,000
June,	63,374,000	68,329,000	69,905,000	77,639,000	77,952,000
July,	69,343,000	73,642,000	69,667,000	80,000,000	85,525,000
August,	66,983,000	67,995,000	72,233,000	78,537,000	84,103,000
September,	64,654,000	67,137,000	73,724,000	74,160,000	84,296,000
October,	63,770,000	62,735,000	67,028,000	71,762,000	79,551,000
November,	61,204,000	62,231,000	64,881,000	71,933,000	72,762,000
December,	66,700,000	65,108,000	70,443,000	79,449,000	76,594,000
Average,	66,165,000	65,382,000	69,499,000	78,360,000	80,793,000
Population,	723,153	743,354	763,557	786,385	809,213
Per capita,	91.5	88.0	91.0	99.7	99.8

MONTH.	1898.	1899.	1900.	1901.	1902.
January,	83,880,000	96,442,000	100,055,000	111,275,000	118,435,000
February,	87,475,000	103,454,000	98,945,000	117,497,000	117,268,000
March,	85,468,000	90,200,000	97,753,000	105,509,000	108,461,000
April,	76,574,000	86,491,000	89,497,000	93,317,000	103,153,000
May,	76,677,000	89,448,000	87,780,000	95,567,000	106,692,000
June,	83,463,000	97,691,000	98,581,000	103,420,000	110,002,000
July,	88,228,000	96,821,000	107,786,000	106,905,000	108,340,000
August,	87,558,000	92,072,000	102,717,000	102,815,000	107,045,000
September,	88,296,000	91,478,000	103,612,000	102,103,000	107,752,000
October,	81,770,000	89,580,000	98,358,000	103,389,000	106,560,000
November,	78,177,000	86,719,000	93,648,000	101,324,000	105,175,000
December,	86,355,000	85,840,000	97,844,000	113,268,000	125,434,000
Average,	83,651,000	92,111,000	98,059,000	104,645,000	110,345,000
Population,	832,042	854,870	877,698	892,740	907,780
Per capita,	100.5	107.8	111.7	117.2	121.6

TABLE No. 28. — (*Pump Basis.*) *Consumption of Water, etc.* — Concluded.

[Gallons per day.]

MONTH.	**1903.**	**1904.**	**1905.**	**1906.**	**1907.**
January,	125,176,000	137,771,000	130,878,000	126,093,000	137,730,000
February,	122,728,000	143,222,000	140,595,000	130,766,000	150,822,000
March,	111,977,000	123,334,000	120,879,000	123,570,000	134,202,000
April,	107,179,000	108,688,000	111,898,000	118,428,000	121,556,000
May,	111,589,000	111,715,000	115,804,000	122,404,000	123,502,000
June,	105,590,000	111,209,000	117,441,000	121,882,000	125,623,000
July,	107,562,000	113,584,000	124,769,000	118,726,000	128,779,000
August,	103,570,000	112,836,000	121,158,000	120,591,000	131,098,000
September,	106,772,000	114,188,000	120,103,000	121,685,000	124,751,000
October,	103,602,000	108,290,000	118,301,000	116,561,000	124,051,000
November,	103,477,000	108,054,000	116,693,000	113,746,000	119,627,000
December,	114,721,000	125,119,000	122,696,000	130,995,000	122,407,000
Average,	110,277,000	118,114,000	121,671,000	122,085,000	128,561,000
Population,	922,820	937,860	955,920	981,690	1,007,520
Per capita,	119.5	125.9	127.3	124.4	127.6

MONTH.	**1908.**	**1909.**	**1910.**	**1911.**	**1912.**
January,	132,376,000	133,275,000	127,568,000	123,281,000	137,277,000
February,	146,199,000	130,763,000	131,093,000	124,359,000	141,440,000
March,	128,884,000	126,842,000	117,078,000	116,669,000	122,804,000
April,	128,926,000	125,335,000	112,775,000	111,656,000	113,308,000
May,	131,040,000	123,305,000	112,073,000	118,095,000	114,548,000
June,	139,843,000	125,179,000	114,082,000	114,145,000	118,793,000
July,	138,232,000	126,765,000	122,743,000	123,052,000	120,261,000
August,	128,073,000	121,781,000	118,373,000	111,091,000	112,968,000
September,	129,972,000	118,043,000	112,434,000	108,726,000	112,352,000
October,	124,189,000	115,939,000	112,332,000	106,873,000	110,220,000
November,	117,119,000	111,664,000	107,528,000	105,373,000	109,289,000
December,	124,468,000	115,733,000	121,994,000	104,592,000	110,114,000
Average,	130,712,000	122,851,000	117,458,000	113,951,000	118,546,000
Population,	1,025,890	1,051,420	1,076,930	1,102,210	1,128,470
Per capita,	127.4	116.8	109.1	103.4	105.1

Newton has not been supplied from the Metropolitan Works, but Hyde Park was supplied as part of Boston after February 5, 1912.

TABLE No. 29. — *Chemical Examinations of Water from the Wachusett Reservoir, Clinton.*

[Parts per 100,000.]

Number.	Date of Collection.	Appearance.			Odor.		Residue on Evaporation.		Ammonia.				Chlorine.	Nitrogen as		Oxygen consumed.	Hardness.
				Color.						Albuminoid.							
		Turbidity.	Sediment.	Platinum Standard.	Cold.	Hot.	Total.	Loss on Ignition.	Free.	Total.	Dissolved.	Suspended.		Nitrates.	Nitrites.		
97399	Jan. 2	None.	V. slight.	.05	Faintly vegetable.	Faintly vegetable and faintly unpleasant.	3.35	1.20	.0014	.0166	.0148	.0018	.30	.0010	.0000	.21	1.1
97637	Jan. 16	V. slight.	V. slight.	.07	V. faintly vegetable.	Faintly vegetable.	2.55	1.05	.0022	.0118	.0106	.0012	.28	.0020	.0000	.22	1.3
97910	Feb. 6	None.	V. slight.	.09	V. faintly vegetable.	Faintly vegetable.	2.90	1.10	.0022	.0102	.0096	.0006	.27	.0010	.0000	.42	1.3
98146	Feb. 20	V. slight.	V. slight.	.10	Faintly vegetable.	Faintly vegetable.	3.65	1.00	.0042	.0104	.0090	.0014	.29	.0030	.0000	.44	1.3
98399	Mar. 5	None.	V. slight.	.09	V. faintly vegetable.	V. faintly vegetable.	2.20	1.00	.0026	.0104	.0092	.0012	.28	.0020	.0000	.29	1.3
98690	Mar. 19	V. slight.	V. slight.	.10	V. faintly vegetable.	Faintly vegetable.	3.25	0.95	.0018	.0110	.0086	.0024	.29	.0010	.0000	.24	1.3
98931	Apr. 2	None.	V. slight.	.10	V. faintly vegetable and unpleasant.	Faintly vegetable and unpleasant.	2.20	1.05	.0020	.0130	.0110	.0020	.28	.0030	.0000	.32	1.3
99195	Apr. 16	None.	V. slight.	.10	V. faintly vegetable.	Faintly vegetable.	2.70	1.30	.0018	.0122	.0098	.0024	.26	.0010	.0000	.24	1.3
99538	May 7	V. slight.	V. slight.	.10	V. faintly vegetable.	Faintly vegetable.	3.15	0.90	.0016	.0160	.0144	.0016	.28	.0020	.0002	.32	1.6
99818	May 21	V. slight.	Slight.	.19	V. faintly vegetable.	Faintly vegetable.	3.30	1.05	.0018	.0110	.0096	.0014	.28	.0010	.0000	.24	0.8
100039	June 4	V. slight.	V. slight.	.15	Faintly vegetable.	Distinctly vegetable.	2.90	1.00	.0018	.0128	.0094	.0034	.25	.0010	.0000	.28	1.1
100376	June 18	V. slight.	V. slight.	.15	Faintly vegetable.	Distinctly vegetable.	3.40	1.25	.0032	.0112	.0100	.0012	.28	.0020	.0000	.27	1.3
100723	July 1	V. slight.	Slight.	.12	V. faintly vegetable and unpleasant.	Faintly vegetable and unpleasant.	3.95	1.15	.0016	.0160	.0110	.0050	.28	.0000	.0000	.24	1.3
101231	July 23	V. slight.	Slight.	.15	V. faintly vegetable.	Faintly vegetable.	4.10	1.20	.0008	.0136	.0126	.0010	.27	.0000	.0000	.22	1.4
101502	Aug. 6	V. slight.	V. slight.	.12	V. faintly vegetable.	Faintly vegetable.	3.25	1.10	.0022	.0160	.0116	.0044	.28	.0000	.0000	.25	1.6
101878	Aug. 20	V. slight.	V. slight.	.10	V. faintly vegetable.	Faintly vegetable.	3.00	0.90	.0034	.0134	.0116	.0018	.28	.0000	.0000	.27	1.0
102245	Sept. 3	None.	V. slight.	.12	V. faintly vegetable.	Faintly vegetable.	2.20	1.00	.0040	.0158	.0144	.0014	.25	.0010	.0000	.22	1.3
102606	Sept. 17	None.	V. slight.	.10	V. faintly vegetable.	Faintly vegetable.	2.70	0.95	.0022	.0152	.0106	.0046	.27	.0010	.0000	.24	1.3
102975	Oct. 1	V. slight.	V. slight.	.10	V. faintly vegetable.	Faintly fishy.	2.20	1.00	.0024	.0144	.0114	.0030	.29	.0030	.0000	.24	0.8
103328	Oct. 15	V. slight.	Slight.	.10	Faintly vegetable and unpleasant.	Faintly vegetable and unpleasant.	3.00	1.10	.0026	.0114	.0100	.0014	.28	.0000	.0000	.26	1.3
103848	Nov. 5	V. slight.	Slight.	.10	V. faintly unpleasant.	Faintly unpleasant.	3.20	1.25	.0020	.0124	.0096	.0028	.29	.0000	.0001	.24	1.3
104177	Nov. 19	None.	V. slight.	.11	V. faintly vegetable.	V. faintly vegetable.	3.20	1.15	.0034	.0118	.0108	.0010	.28	.0010	.0000	.28	1.3
104539	Dec. 3	V. slight.	V. slight.	.10	V. faintly vegetable.	Faintly vegetable.	3.20	1.50	.0024	.0104	.0098	.0006	.28	.0010	.0000	.24	0.8
104852	Dec. 18	V. slight.	V. slight.	.05	Faintly vegetable.	Faintly vegetable.	2.80	0.80	.0032	.0132	.0120	·0012	.26	.0010	.0000	.22	1.3
Av.	....	....	....	.11	....	....	3.01	1.08	.0024	.0129	.0109	.0020	.28	.0012	.0000	.27	1.2

TABLE No. 30. — *Chemical Examinations of Water from the Sudbury Reservoir.*

[Parts per 100,000.]

Number.	Date of Collection.	APPEARANCE.			ODOR.		RESIDUE ON EVAPORATION.		AMMONIA.				Chlorine.	NITROGEN AS		Oxygen consumed.	Hardness.
				COLOR.						ALBUMINOID.							
		Turbidity.	Sediment.	Platinum Standard.	Cold.	Hot.	Total.	Loss on Ignition.	Free.	Total.	Dissolved.	Suspended.		Nitrates.	Nitrites.		
97375	Jan. 1	V. slight.	V. slight.	.10	Faintly vegetable.	Distinctly vegetable.	4.00	1.20	.0020	.0134	.0098	.0036	.36	.0020	.0000	.20	1.4
97876	Feb. 5	V. slight.	Slight.	.14	V. faintly vegetable and unpleasant.	Faintly vegetable and unpleasant.	3.80	1.40	.0038	.0146	.0122	.0024	.34	.0050	.0000	.34	1.7
98348	Mar. 4	V. slight.	V. slight.	.10	None.	V. faintly vegetable.	3.20	1.05	.0024	.0114	.0090	.0024	.34	.0060	.0000	.24	1.3
98876	Apr. 1	V. slight.	V. slight.	.15	V. faintly vegetable.	Faintly vegetable.	3.85	1.15	.0032	.0132	.0104	.0028	.31	.0080	.0000	.30	1.3
99461	May 6	V. slight.	Considerable.	.24	V. faintly vegetable.	Faintly vegetable.	4.35	2.05	.0026	.0190	.0156	.0034	.35	.0130	.0002	.40	1.6
99998	June 3	V. slight.	V. slight.	.21	Faintly vegetable.	Distinctly vegetable.	3.70	1.85	.0026	.0152	.0126	.0026	.35	.0070	.0001	.33	1.7
100704	July 1	V. slight.	Slight.	.20	Faintly vegetable.	Distinctly vegetable.	4.50	1.10	.0030	.0202	.0152	.0050	.37	.0040	.0000	.35	1.4
101462	Aug. 5	V. slight.	Slight.	.15	Faintly vegetable.	Distinctly vegetable.	3.50	1.30	.0018	.0186	.0152	.0034	.35	.0000	.0000	.29	2.0
102251	Sept. 3	V. slight.	Slight.	.11	Distinctly unpleasant, decaying organisms.	Distinctly unpleasant, decaying organisms.	3.00	1.00	.0024	.0166	.0122	.0044	.32	.0000	.0000	.26	1.4
102946	Sept. 30	V. slight.	Slight.	.10	V. faintly vegetable.	V. faintly vegetable.	3.05	1.10	.0020	.0130	.0106	.0024	.30	.0010	.0000	.21	1.3
103807	Nov. 4	V. slight.	V. slight.	.10	V. faintly vegetable.	Faintly vegetable.	2.75	1.00	.0018	.0130	.0114	.0016	.32	.0000	.0000	.30	1.3
104489	Dec. 2	V. slight.	V. slight.	.10	V. faintly vegetable.	Faintly vegetable.	3.05	1.00	.0024	.0132	.0124	.0008	.30	.0020	.0000	.21	1.3
Av.	....	....	....	.14	....	....	3.56	1.27	.0025	.0151	.0122	.0029	.33	.0040	.0000	.29	1.5

TABLE No. 31. — *Chemical Examinations of Water from Spot Pond, Stoneham.*

[Parts per 100,000.]

Number.	Date of Collection.	APPEARANCE.			ODOR.		RESIDUE ON EVAPORATION.		AMMONIA.				Chlorine.	NITROGEN AS		Oxygen consumed.	Hardness.
				COLOR.						ALBUMINOID.							
		Turbidity.	Sediment.	Platinum Standard.	Cold.	Hot.	Total.	Loss on Ignition.	Free.	Total.	Dissolved.	Suspended.		Nitrates.	Nitrites.		
97413	Jan. 3	V. slight.	V. slight.	.09	Faintly vegetable.	Faintly vegetable.	3.55	1.25	.0018	.0168	.0148	.0020	.38	.0010	.0000	.28	1.6
97871	Feb. 12	V. slight.	Slight.	.10	V. faintly vegetable.	Faintly vegetable.	4.10	1.65	.0018	.0148	.0138	.0010	.44	.0010	.0000	.28	2.0
98402	Mar. 6	V. slight.	V. slight.	.11	Faint cucumber odor.	Distinct cucumber odor.	4.10	1.15	.0016	.0156	.0118	.0038	.41	.0040	.0000	.36	1.7
98868	Apr. 1	V. slight.	V. slight.	.09	Faintly fishy.	Distinctly fishy.	3.75	1.00	.0016	.0152	.0122	.0030	.38	.0010	.0000	.24	1.6
99453	May 6	V. slight.	Slight.	.09	Faintly vegetable.	Faintly vegetable.	4.65	1.80	.0016	.0198	.0128	.0070	.40	.0020	.0001	.26	1.6
100022	June 4	None.	V. slight.	.10	Faintly vegetable.	Distinctly vegetable.	3.85	1.40	.0008	.0146	.0108	.0038	.38	.0010	.0000	.24	1.6
100830	July 8	V. slight.	Slight.	.08	V. faintly vegetable.	V. faintly vegetable.	4.05	1.20	.0010	.0178	.0158	.0020	.44	.0000	.0000	.21	1.6
101521	Aug. 7	V. slight.	V. slight.	.10	Sweetish and v. faintly vegetable.	Sweetish and faintly vegetable.	4.00	1.10	.0016	.0174	.0154	.0020	.40	.0000	.0000	.28	2.1
102372	Sept. 9	None.	Slight.	.09	Faintly unpleasant.	Faintly unpleasant.	3.80	1.00	.0030	.0180	.0138	.0042	.40	.0000	.0000	.31	1.3
102937	Sept. 30	Slight.	Slight.	.10	None.	None.	3.40	1.30	.0030	.0176	.0144	.0032	.39	.0000	.0000	.21	1.7
103851	Nov. 5	V. slight.	V. slight.	.06	V. faintly vegetable.	Faintly vegetable.	3.45	1.15	.0020	.0182	.0136	.0046	.41	.0000	.0000	.25	1.7
104553	Dec. 4	None.	V. slight.	.08	V. faintly vegetable.	Faintly vegetable.	4.55	1.75	.0020	.0182	.0128	.0054	.36	.0000	.0000	.18	1.7
Av.	....	....	....	.09	....	....	3.94	1.31	.0018	.0170	.0135	.0035	.40	.0008	.0000	.26	1.7

TABLE No. 32. — *Chemical Examinations of Water from Lake Cochituate.*

[Parts per 100,000.]

Number.	Date of Collection.	APPEARANCE.			ODOR.		RESIDUE ON EVAPORATION.		AMMONIA.				Chlorine.	NITROGEN AS		Oxygen consumed.	Hardness.
				COLOR.						ALBUMINOID.							
		Turbidity.	Sediment.	Platinum Standard.	Cold.	Hot.	Total.	Loss on Ignition.	Free.	Total.	Dissolved.	Suspended.		Nitrates.	Nitrites.		
97384	Jan. 1	V. slight.	Considerable.	.11	Faintly vegetable.	Distinctly vegetable.	6.05	1.75	.0002	.0256	.0156	.0100	.69	.0000	.0000	.25	2.7
97885	Feb. 5	Slight.	Slight.	.12	Faintly vegetable and unpleasant.	Faintly vegetable and unpleasant.	5.95	2.05	.0020	.0218	.0168	.0050	.76	.0000	.0000	.32	3.0
98370	Mar. 4	V. slight.	Slight.	.15	V. faintly vegetable.	Faintly vegetable.	6.35	1.70	.0016	.0254	.0136	.0118	.72	.0000	.0000	.37	2.5
98895	Apr. 1	V. slight.	Slight.	.22	V. faintly vegetable.	Faintly vegetable.	5.70	2.05	.0006	.0268	.0172	.0096	.66	.0020	.0000	.46	2.6
99472	May 6	V. slight.	Considerable.	.25	Faintly vegetable.	Faintly vegetable.	6.55	2.15	.0008	.0374	.0188	.0186	.66	.0000	.0000	.46	2.2
100007	June 3	V. slight.	Considerable.	.28	Faintly vegetable.	Distinctly vegetable.	6.65	2.75	.0006	.0218	.0154	.0064	.67	.0010	.0001	.50	2.6
107112	July 1	V. slight.	V. slight.	.22	Faintly vegetable.	Distinctly vegetable and faintly unpleasant.	7.20	1.90	.0012	.0212	.0176	.0036	.69	.0010	.0000	.48	2.6
101459	Aug. 5	V. slight.	Considerable.	.21	Faintly vegetable and earthy.	Distinctly vegetable and earthy.	6.40	1.55	.0008	.0294	.0208	.0086	.68	.0000	.0002	.44	3.0
102316	Sept. 5	V. slight.	Slight.	.16	Faintly vegetable.	Distinctly vegetable.	6.60	2.05	.0016	.0296	.0232	.0064	.67	.0000	.0001	.40	2.7
102962	Oct. 1	Slight.	Considerable.	.15	V. faintly vegetable.	Faintly vegetable.	6.30	1.85	.0044	.0404	.0186	.0218	.69	.0000	.0000	.42	2.6
103811	Nov. 4	Slight.	Considerable.	.20	V. faintly vegetable.	Faintly vegetable and unpleasant.	6.00	2.10	.0020	.0296	.0168	.0128	.70	.0000	.0000	.44	2.6
104521	Dec. 3	V. slight.	Slight.	.21	Faintly unpleasant.	Distinctly unpleasant.	7.40	2.70	.0044	.0356	.0164	.0192	.70	.0000	.0000	.39	2.6
Av.	....	....	....	.19	....	....	6.43	2.05	.0017	.0287	.0176	.0112	.69	.0003	.0000	.41	2.6

TABLE No. 33. — *Chemical Examinations of Water from a Tap at the State House, Boston.*

[Parts per 100,000.]

Number.	Date of Collection.	APPEARANCE.			ODOR.		RESIDUE ON EVAPORATION.		AMMONIA.				Chlorine.	NITROGEN AS		Oxygen consumed.	Hardness.
		Turbidity.	Sediment.	COLOR.	Cold.	Hot.	Total.	Loss on Ignition.	Free.	ALBUMINOID.				Nitrates.	Nitrites.		
				Platinum Standard.						Total.	Dissolved.	Suspended.					
97360	Jan. 1	V. slight.	V. slight.	.15	V. faintly vegetable.	Faintly vegetable.	3.65	1.10	.0014	.0130	.0118	.0012	.34	.0060	.0000	.29	1.4
97859	Feb. 5	V. slight.	V. slight.	.14	V. faintly vegetable.	Faintly vegetable.	3.95	1.60	.0024	.0178	.0112	.0066	.38	.0060	.0000	.34	2.0
98345	Mar. 4	V. slight.	V. slight.	.22	V. faintly vegetable.	Faintly vegetable.	4.25	1.50	.0024	.0138	.0106	.0032	.38	.0130	.0001	.32	2.0
98859	Apr. 1	Slight.	Slight.	.18	Distinctly geranium, Asterionella.	Distinctly geranium, Asterionella.	3.25	1.20	.0018	.0136	.0102	.0034	.33	.0120	.0001	.32	1.3
99450	May 6	V. slight.	Slight.	.22	Distinctly geranium, Asterionella.	Distinctly geranium, Asterionella.	4.20	1.45	.0016	.0178	.0142	.0036	.35	.0100	.0001	.32	1.6
99984	June 3	V. slight.	Slight.	.22	Distinctly vegetable.	Distinctly vegetable.	3.95	1.10	.0020	.0154	.0128	.0026	.34	.0100	.0000	.33	2.1
100690	July 1	V. slight.	V. slight.	.20	Faintly cucumber, Synura.	Distinctly cucumber, Synura.	4.20	1.20	.0024	.0170	.0132	.0038	.40	.0100	.0002	.33	2.0
101338	July 29	V. slight.	V. slight.	.11	Faintly vegetable.	Distinctly vegetable.	3.50	1.15	.0008	.0130	.0106	.0024	.34	.0050	.0000	.25	2.1
102226	Sept. 3	V. slight.	V. slight.	.13	None.	V. faintly vegetable.	3.95	1.05	.0020	.0170	.0132	.0038	.39	.0020	.0000	.25	2.0
102935	Sept. 30	Slight.	Slight.	.12	V. faintly vegetable.	Faintly vegetable.	4.50	1.30	.0012	.0186	.0132	.0054	.43	.0000	.0000	.32	1.7
103798	Nov. 4	V. slight.	V. slight.	.11	V. faintly unpleasant.	Faintly unpleasant.	3.70	1.00	.0020	.0140	.0110	.0030	.33	.0000	.0000	.28	1.3
104485	Dec. 2	V. slight.	V. slight.	.09	V. faintly vegetable.	Faintly vegetable.	3.25	1.15	.0020	.0132	.0110	.0022	.31	.0000	.0000	.10	1.3
Av.	....	....	....	.17	....	....	3.86	1.23	.0018	.0154	.0119	.0034	.36	.0062	.0000	.29	1.7

TABLE No. 34. — *Averages of Examinations of Water from Various Parts of the Metropolitan Water Works in 1912.*

[Parts per 100,000.]

LOCALITY.	Samples collected.	COLOR.	RESIDUE ON EVAPORATION.		AMMONIA.				Chlorine.	NITROGEN AS		Oxygen Consumed.	Hardness.
						ALBUMINOID.							
		Platinum Standard.	Total.	Loss on Ignition.	Free.	Total.	Dissolved.	Suspended.		Nitrates.	Nitrites.		
Quinepoxet River, Holden,	Semi-monthly,	.37	4.34	1.48	.0030	.0170	.0137	.0034	.50	.0033	.0001	.50	1.1
Stillwater River, Sterling,	Semi-monthly,	.32	3.77	1.35	.0021	.0135	.0117	.0018	.26	.0022	.0000	.42	1.2
Wachusett Reservoir, West Boylston,	Semi-monthly,	.26	3.46	1.30	.0022	.0142	.0113	.0029	.29	.0030	.0000	.39	1.2
Wachusett Reservoir, Clinton, surface,	Semi-monthly,	.11	3.01	1.08	.0024	.0129	.0109	.0020	.28	.0012	.0000	.27	1.2
Wachusett Reservoir, Clinton, bottom,	Semi-monthly,	.11	3.06	1.06	.0027	.0112	.0096	.0016	.28	.0022	.0000	.27	1.2
Marlborough (Walker's Brook),	Monthly,	.51	24.84	5.95	1.1265	.0570	.0454	.0161	4.75	.1695	.0231	.90	8.1
Marlborough Brook filter-beds, effluent,[1]	Monthly,	.08	18.08	–	.0389	.0109	–	–	2.33	.2075	.0009	.07	6.6
Wachusett Aqueduct, Southborough,[2]	Monthly,	.14	3.09	1.14	.0022	.0125	.0107	.0027	.29	.0021	.0000	.26	1.3
Sudbury Reservoir, surface,	Monthly,	.14	3.56	1.27	.0025	.0151	.0122	.0029	.33	.0040	.0000	.29	1.5
Sudbury Reservoir, bottom,	Monthly,	.14	3.52	1.23	.0042	.0149	.0120	.0029	.34	.0043	.0000	.29	1.6
Framingham Reservoir No. 3, inlet,	Monthly,	.14	3.62	1.23	.0033	.0144	.0124	.0020	.34	.0050	.0000	.28	1.5
Framingham Reservoir No. 3, near dam,	Monthly,	.16	3.88	1.45	.0037	.0155	.0126	.0029	.33	.0048	.0000	.29	1.6
Hopkinton Reservoir, inlet,	Monthly,	1.36	6.73	3.14	.0052	.0363	.0317	.0046	.49	.0005	.0000	1.44	1.8
Hopkinton Reservoir, surface,	Monthly,	.69	4.98	2.09	.0049	.0226	.0192	.0034	.43	.0028	.0001	.81	1.6
Hopkinton Reservoir, bottom,	Monthly,	.67	4.91	2.05	.0051	.0211	.0162	.0029	.43	.0058	.0000	.80	1.6
Ashland Reservoir, inlet,	Monthly,	1.06	5.53	2.54	.0042	.0315	.0270	.0045	.44	.0028	.0000	1.13	1.7
Ashland Reservoir, surface,	Monthly,	.71	4.69	2.06	.0048	.0264	.0215	.0049	.37	.0024	.0000	.84	1.5
Ashland Reservoir, bottom,	Monthly,	.69	4.73	2.11	.0042	.0238	.0208	.0030	.36	.0035	.0000	.81	1.4
Framingham Reservoir No. 2, inlet,	Monthly,	.87	5.40	2.20	.0055	.0291	.0246	.0045	.48	.0065	.0001	.95	1.7
Framingham Reservoir No. 2, near dam,	Monthly,	.86	5.38	2.26	.0062	.0269	.0226	.0023	.44	.0053	.0001	.92	1.7
Lake Cochituate, surface,	Monthly,	.19	6.43	2.05	.0017	.0287	.0176	.0112	.69	.0003	.0000	.41	2.6
Lake Cochituate, bottom,	Monthly,	.84	7.67	2.73	.0358	.0403	.0197	.0206	.69	.0004	.0001	.54	3.0
Weston Reservoir,	Monthly,	.12	3.68	1.23	.0023	.0147	.0119	.0028	.33	.0043	.0000	.29	1.5
Terminal chamber, Sudbury Aqueduct,[2]	Monthly,	.19	3.96	1.44	.0033	.0160	.0131	.0029	.34	.0068	.0001	.32	1.6
Spot Pond,	Monthly,	.09	3.94	1.31	.0018	.0170	.0135	.0035	.40	.0008	.0000	.26	1.7
Tap in Revere,	Monthly,	.10	3.75	1.26	.0014	.0136	.0117	.0020	.39	.0011	.0000	.26	1.8
Tap at State House,	Monthly,	.17	3.86	1.23	.0018	.0154	.0119	.0034	.36	.0062	.0000	.29	1.7
Tap in Quincy,	Monthly,	.15	3.85	1.28	.0016	.0128	.0105	.0015	.37	.0081	.0000	.26	1.7

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[1] Average of 6 samples.

[2] Average of 11 samples.

TABLE NO. 35. — *Chemical Examinations of Water from a Faucet in Boston, from 1892 to 1912.*

[Parts per 100,000.]

YEAR.	COLOR.		RESIDUE ON EVAPORATION.		AMMONIA.				Chlorine.	NITROGEN AS		Oxygen consumed.	Hardness.
						ALBUMINOID.							
	Nessler Standard.	Platinum Standard.	Total.	Loss on Ignition.	Free.	Total.	Dissolved.	Suspended.		Nitrates.	Nitrites.		
1892, . .	.37	.37	4.70	1.67	.0007	.0168	.0138	.0030	.41	.0210	.0001	-	1.9
1893, . .	.61	.53	4.54	1.84	.0010	.0174	.0147	.0027	.38	.0143	.0001	.60	1.8
1894, . .	.69	.58	4.64	1.83	.0006	.0169	.0150	.0019	.41	.0106	.0001	.63	1.7
1895, . .	.72	.59	4.90	2.02	.0006	.0197	.0175	.0022	.40	.0171	.0001	.69	0.7
1896, . .	.49	.45	4.29	1.67	.0005	.0165	.0142	.0023	.37	.0155	.0001	.56	1.4
1897, . .	.65	.55	4.82	1.84	.0009	.0193	.0177	.0016	.40	.0137	.0001	.64	1.6
1898, . .	.41	.40	4.19	1.60	.0008	.0152	.0136	.0016	.29	.0097	.0001	.44	1.4
1899, . .	.23	.28	3.70	1.30	.0006	.0136	.0122	.0014	.24	.0137	.0001	.35	1.1
1900, . .	.24	.29	3.80	1.20	.0012	.0157	.0139	.0018	.25	.0076	.0001	.38	1.3
1901, . .	.24	.29	4.43	1.64	.0013	.0158	.0142	.0016	.30	.0173	.0001	.42	1.7
1902, . .	.26	.30	3.93	1.56	.0016	.0139	.0119	.0020	.29	.0092	.0000	.40	1.3
1903, . .	.25	.29	3.98	1.50	.0013	.0125	.0110	.0015	.30	.0142	.0001	.39	1.5
1904, . .	-	.23	3.93	1.59	.0023	.0139	.0121	.0018	.34	.0110	.0001	.37	1.5
1905, . .	-	.24	3.86	1.59	.0020	.0145	.0124	.0021	.35	.0083	.0001	.35	1.4
1906, . .	-	.24	3.86	1.39	.0018	.0159	.0134	.0025	.34	.0054	.0001	.36	1.3
1907, . .	-	.22	3.83	1.40	.0013	.0129	.0109	.0020	.33	.0068	.0001	.32	1.3
1908, . .	-	.19	3.50	1.35	.0011	.0115	.0092	.0024	.33	.0092	.0001	.26	1.2
1909, . .	-	.18	3.46	1.43	.0011	.0128	.0103	.0025	.28	.0034	.0000	.25	1.3
1910, . .	-	.14	3.05	1.24	.0013	.0118	.0102	.0016	.28	.0030	.0000	.22	1.1
1911, . .	-	.25	4.18	1.66	.0015	.0156	.0128	.0029	.38	.0029	.0000	.33	1.4
1912, . .	-	.17	3.86	1.23	.0018	.0154	.0119	.0034	.36	.0062	.0000	.29	1.7

TABLE NO. 36. —*Microscopic Organisms in Water from Various Parts of the Metropolitan Water Works, from 1898 to 1912, inclusive.*

[Standard units per cubic centimeter; averages from weekly or biweekly observations.]

YEAR.	WACHUSETT RESERVOIR.		SUDBURY RESERVOIR.		LAKE COCHITUATE.		FRAMINGHAM RESERVOIR. No. 3.	FRAMINGHAM RESERVOIR. No. 2.	ASHLAND RESERVOIR.	HOPKINTON RESERVOIR.	WHITEHALL RESERVOIR.
	Surface.	Bottom.	Surface.	Bottom.	Surface.	Bottom.	Surface.	Mid-depth.	Surface.	Surface.	Surface.
1898,	-	-	354	149	830	696	390	245	263	944	690
1899,	-	-	470	252	905	644	440	218	357	715	393
1900,	-	-	498	361	1,758	1,071	645	365	390	980	437
1901,	-	-	337	225	992	702	336	149	244	450	705
1902,	-	-	590	402	1,071	730	627	204	550	588	198
1903,	-	-	549	388	931	795	459	169	323	231	327
1904,	313	-	517	376	663	542	475	174	153	106	375
1905,	769	592	644	502	1,255	503	535	158	289	240	147
1906,	446	272	953	714	1,407	1,143	692	226	431	475	1,279
1907,	425	212	513	419	1,123	1,200	413	205	378	336	961
1908,	731	466	850	885	1,559	1,241	932	725	699	516	708
1909,	2,151	1,937	2,474	2,513	1,142	1,198	2,372	610	603	294	445
1910,	480	328	464	556	928	1,033	455	436	426	387	154
1911,	649	368	990	988	1,942	2,216	1,140	378	592	457	397
1912,	585	368	939	882	4,682	7,873	888	241	665	516	390
Mean,	728	568	743	641	1,413	1,439	720	300	424	482	507

See note at end of this table.

TABLE No. 36. — *Microscopic Organisms in Water, etc.* — Concluded.

[Standard units per cubic centimeter; averages from weekly or biweekly observations.]

YEAR.	WESTON RESERVOIR.	SPOT POND.	CHESTNUT HILL RESERVOIR.			TAPS.			
			SUDBURY AQUEDUCT.	COCHITUATE AQUEDUCT.	EFFLUENT GATE-HOUSE.	Southern Low Service.	Southern High Service.	Northern Low Service.	Northern High Service.
	Surface.	Surface.	Inlet.	Inlet.	No. 2.				
1898,	-	485	304	544	304	230	-	-	-
1899,	-	1,129	359	992	329	192	201	-	-
1900,	-	573	568	1,139	897	468	452	-	-
1901,	-	628	344	697	413	243	280	-	-
1902,	-	581	563	937	525	367	451	-	-
1903,	-	650	450	860	435	286	398	-	-
1904,	-	465	405	838	472	303	470	274	189
1905,	-	609	551	904	554	528	671	363	388
1906,	783	671	631	1,042	721	550	583	326	422
1907,	443	590	349	909	419	312	427	205	422
1908,	979	741	783	1,073	689	666	695	443	481
1909,	2,390	1,079	1,999	632	1,899	1,913	1,959	1,313	677
1910,	625	622	457	-	465	447	421	221	374
1911,	934	748	700	1,382	954	778	735	349	461
1912,	1,117	716	855	3,887	919	1,035	967	412	462
Mean,	1,040	686	621	1,131	666	555	622	434	431

NOTE. — A large growth of Asterionella originated in the Wachusett Reservoir in 1909, causing the large number of organisms in the water of Sudbury Reservoir and Framingham Reservoir No. 3, Weston and Chestnut Hill reservoirs, Spot Pond and in the water drawn from taps.

TABLE NO. 37. — *Number of Bacteria per Cubic Centimeter in Water from Various Parts of the Metropolitan Water Works, from 1898 to 1912, inclusive.*

[Averages of weekly determinations.]

YEAR.	CHESTNUT HILL RESERVOIR.			SOUTHERN SERVICE TAPS.	
	Sudbury Aqueduct Terminal Chamber.	Cochituate Aqueduct.	Effluent Gate-house No. 2.	Low Service, 185 Boylston Street.	High Service, 1 Ashburton Place.
1898,	207	145	111	96	–
1899,	224	104	217	117	123
1900,	248	113	256	188	181
1901,	225	149	169	162	168
1902,	203	168	121	164	246
1903,	76	120	96	126	243
1904,	347	172	220	176	355
1905,	495	396	489	231	442
1906,	231	145	246	154	261
1907,	147	246	118	130	176
1908,	162	138	137	136	148
1909,	198	229	119	150	195
1910,	216	–	180	178	213
1911,	205	204	151	175	197
1912,	429	450	227	249	259
Mean,	241	191	190	162	229

TABLE NO. 38. — *Colors of Water from Various Parts of the Metropolitan Water Works in 1912. (Means of Weekly Determinations.)*

[Platinum Standard.]

MONTH.	WACHUSETT RESERVOIR.						SUDBURY RESERVOIR.				FRAMINGHAM RESERVOIR.		LAKE COCHITUATE.			
											No. 2.	No. 3.				
	Surface.	Mid-depth.	Bottom.	Worcester Street Bridge.	Quinepoxet River.	Stillwater River.	Surface.	Mid-depth.	Bottom.	End of Open Channel.	Mid-depth.	Mid-depth.	Surface.	Mid-depth.	Bottom.	Influent Streams.[1]
January,	.08	.08	.08	.33	.34	.29	.10	.10	.10	.11	.79	.11	.12	.12	.13	.36
February,	.09	.09	.09	.31	.32	.29	.13	.13	.13	.16	.72	.14	.20	.15	.19	.49
March,	.13	.12	.12	.35	.36	.30	.15	.15	.15	.51	.65	.19	.20	.14	.18	.28
April,	.16	.15	.15	.36	.39	.35	.21	.21	.21	.43	.64	.22	.28	.28	.28	.52
May,	.17	.17	.17	.42	.51	.44	.25	.25	.26	.25	.86	.26	.30	.29	.33	.55
June,	.16	.16	.16	.38	.44	.39	.22	.23	.23	.21	1.30	.23	.26	.27	.36	.59
July,	.14	.14	.14	.19	.28	.26	.17	.17	.17	.14	.91	.18	.21	.25	.87	.44
August,	.13	.14	.15	.15	.32	.19	.14	.14	.14	.15	.95	.15	.18	.24	1.79	.47
September,	.13	.13	.14	.14	.24	.18	.14	.14	.14	.14	.82	.14	.18	.24	2.63	.42
October,	.13	.13	.14	.14	.21	.17	.13	.13	.13	.13	.69	.13	.18	.21	2.29	.37
November,	.12	.12	.12	.12	.35	.29	.12	.12	.12	.13	.59	.12	.21	.21	1.07	.35
December,	.11	.11	.11	.21	.44	.32	.10	.11	.12	.12	.57	.09	.21	.21	.24	.35
Mean,	.13	.13	.13	.26	.35	.29	.16	.16	.16	.21	.79	.16	.21	.22	.86	.43

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[1] The colors given in this column represent the combined colors of the waters of the four principal feeders. The color of each is determined monthly, and due weight is given in combining the results to the sizes of the streams.

TABLE No. 38. — *Colors of Water, etc.* — Concluded.

[Platinum Standard.]

MONTH.	CHESTNUT HILL RESERVOIR.			SPOT POND.	FELLS RESERVOIR.	NORTHERN SERVICE.		SOUTHERN SERVICE.	
	Inlet (Sudbury Aqueduct).	Inlet (Cochituate Aqueduct).	Effluent Gate-house No. 2.	Mid-depth.	Effluent Gate-house.	Tap at Glenwood Yard, Medford (Low Service).	Tap at Fire Station, Hancock Street, Everett (High Service).	Tap at 185 Boylston Street, Boston (Low Service).	Tap at 1 Ashburton Place, Boston (High Service).
January, ...	.17	-	.17	.10	.10	.17	.10	.14	.17
February, ...	.18	.20	.18	.13	.13	.18	.13	.17	.18
March, ...	.20	-	.20	.13	.13	.20	.13	.17	.20
April, ...	.22	-	.21	.13	.13	.21	.13	.19	.21
May, ...	.26	-	.25	.13	.13	.22	.13	.22	.23
June, ...	.23	.23	.22	.12	.12	.22	.12	.21	.22
July, ...	.18	-	.17	.12	.12	.17	.11	.17	.17
August, ...	.14	.18	.14	.12	.12	.14	.12	.14	.14
September, ...	.14	.18	.15	.12	.12	.14	.12	.14	.14
October, ...	.14	.18	.14	.12	.12	.15	.13	.13	.15
November, ...	.13	.13	.13	.12	.12	.13	.12	.13	.13
December, ...	.11	-	.11	.10	.09	.14	.11	.12	.13
Mean, ...	.18	.18	.17	.12	.12	.17	.12	.16	.17

TABLE No. 39. — *Temperatures of Water from Various Parts of the Metropolitan Water Works in 1912. (Means of Weekly Determinations.)*

[The temperatures are taken at the same places and times as the samples for microscopical examination; the depth given for each reservoir is the depth from high water mark.]

[Degrees Fahrenheit.]

MONTH.	WACHUSETT RESERVOIR.			SUDBURY RESERVOIR (DEPTH AT PLACE OF OBSERVATION 54.5 FEET).				FRAMINGHAM RESERVOIR NO. 3 (DEPTH AT PLACE OF OBSERVATION 20.5 FEET).			LAKE COCHITUATE (DEPTH AT PLACE OF OBSERVATION 62.0 FEET).		
	Surface.	Mid-depth.	Bottom.	Surface.	Mid-depth.	Bottom.	End of Open Channel.	Surface.	Mid-depth.	Bottom.	Surface.	Mid-depth.	Bottom.
January, . . .	33.7	34.2	34.3	33.5	34.1	34.7	33.8	33.6	33.8	33.8	33.2	34.7	35.2
February, . . .	34.5	35.4	35.8	33.0	44.3	35.1	34.5	35.2	35.6	35.7	33.8	35.6	37.0
March, . . .	36.2	37.0	37.5	35.3	35.8	36.3	37.5	36.5	36.7	36.7	37.5	36.0	36.0
April, . . .	41.2	41.0	40.8	44.7	44.3	43.8	44.2	45.2	45.6	45.9	44.8	42.3	42.2
May, . . .	54.4	49.5	48.1	58.0	53.6	52.4	52.3	61.0	59.7	59.1	59.3	49.8	47.0
June, . . .	65.6	54.8	52.0	69.8	66.6	64.9	59.1	70.1	69.9	69.6	71.3	52.5	50.8
July, . . .	74.1	58.9	53.0	73.8	71.6	67.2	61.0	74.9	74.5	73.0	74.5	54.5	50.6
August, . . .	72.0	54.6	52.8	71.9	70.5	69.2	66.0	72.1	71.5	71.3	72.7	54.7	49.6
September, . .	66.9	59.5	53.9	68.4	67.6	67.1	61.0	68.0	67.2	67.1	69.0	54.2	47.8
October, . . .	58.6	58.1	56.1	57.6	56.9	57.9	56.1	56.4	56.4	56.4	55.9	53.6	47.8
November, . .	49.5	49.5	49.7	49.5	49.6	49.7	48.2	46.5	46.5	46.5	47.8	47.8	46.5
December, . .	39.5	39.6	39.7	35.3	37.0	37.5	37.6	36.1	36.2	36.2	38.8	40.3	40.7
Mean, . .	52.2	47.7	46.1	52.6	51.8	51.3	49.3	53.0	52.8	52.6	53.2	46.3	44.3

TABLE No. 39. — *Temperatures of Water, etc.* — Concluded.

[Degrees Fahrenheit.]

MONTH.	CHESTNUT HILL RESERVOIR.	SPOT POND (DEPTH AT PLACE OF OBSERVATION 28.0 FEET).			NORTHERN SERVICE.		SOUTHERN SERVICE.	
	Effluent Gate-house No. 2.	Surface.	Mid-depth.	Bottom.	Tap at Glenwood Yard, Medford (Low Service).	Tap at Fire Station, Hancock Street, Everett (High Service).	Tap at 185 Boylston Street, Boston (Low Service).	Tap at 1 Ashburton Place, Boston (High Service).
January, ...	36.0	34.4	34.7	35.2	38.2	35.6	39.9	41.1
February, . . .	35.9	35.5	35.8	36.3	35.9	37.3	40.4	41.0
March, ...	37.5	38.5	38.5	38.8	37.5	40.3	42.9	43.9
April, ...	46.3	45.8	44.8	44.9	44.0	45.2	49.5	51.5
May, ...	53.4	57.8	57.5	57.1	55.5	57.6	59.4	60.2
June, ...	61.8	66.5	65.8	64.6	64.5	65.9	67.9	68.0
July, ...	74.3	73.6	73.3	70.6	72.6	72.6	74.2	74.4
August, ...	71.9	71.9	71.9	71.9	70.5	71.0	71.2	72.1
September, . . .	67.6	68.2	68.1	67.9	68.1	67.5	67.4	68.5
October, ...	58.3	58.7	58.9	59.0	61.6	59.5	61.0	61.7
November, . . .	48.1	47.7	48.1	48.6	53.5	51.5	52.1	53.2
December, . . .	40.1	37.2	38.4	38.0	44.8	40.5	41.7	45.5
Mean, . . .	52.6	53.0	53.0	52.7	53.9	53.7	55.6	56.8

TABLE No. 40. — *Temperatures of the Air at Three Stations on the Metropolitan Water Works in 1912.*

[Degrees Fahrenheit.]

MONTH.	CHESTNUT HILL RESERVOIR.			FRAMINGHAM.			CLINTON.		
	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.	Maximum.	Minimum.	Mean.
January, ...	50	—8	19.4	50	—18	18.8	49	—15	13.4
February, . . .	56	—7	24.9	50	—7	25.2	56	—6	22.6
March, ...	59	5	34.5	63	0	34.2	59	—1	31.9
April, ...	79	24	47.9	76	24	47.7	73	23	45.1
May, ...	86	32	58.9	85	31	59.4	81	36	57.8
June, ...	91	40	66.7	90	39	67.0	87	39	64.2
July, ...	99	47	72.1	99	46	72.7	94	51	70.7
August, ...	89	45	67.8	88	40	67.7	83	43	65.2
September, . . .	87	37	62.4	88	35	62.1	86	30	60.6
October, ...	82	30	55.0	81	29	54.2	78	30	53.1
November, . . .	69	19	43.1	68	19	42.9	67	21	40.9
December, . . .	68	12	37.9	66	11	35.9	62	12	33.3
Average, . . .	-	-	49.2	-	-	49.0	-	-	46.6

TABLE NO. 41. — *Table showing Length of Main Lines of Water Pipes and Connections owned and operated by Metropolitan Water and Sewerage Board, and Number of Valves set in Same, Dec. 31, 1912.*

	DIAMETER OF PIPES IN INCHES.														Total.
	60	48	42	36	30	24	20	16	14	12	10	8	6	4	
Total length owned and operated Dec. 31, 1911 (feet),	29,334[1]	182,696	8,075	50,968	27,615[2]	69,931	67,327	67,625	26	26,229	3,768	1,841	931	-	536,366[3]
Gate valves in same,	3	49	-	50	28	50	50	74	1	96	18	15	19	-	453
Air valves in same,	25	111	3	42	7	36	40	33	-	10	1	-	-	-	308
Length laid or relaid during 1912 (feet),	-	-	-	10	36	603	178	110	-	437	-	-	14	8	1,396
Gate valves in same,	-	-	-	-	-	1	-	-	-	1	-	-	1	-	3
Air valves in same,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Length abandoned during 1912 (feet),	-	-	-	8	36	281	8	291	-	4	-	-	-	-	628
Gate valves in same,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Air valves in same,	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Length owned and operated Dec. 31, 1912 (feet),	29,334[1]	182,696	8,075	50,970	27,615[2]	70,253	67,497	67,444	26	26,662	3,768	1,841	945	8	537,134[3]
Gate valves in same,	3	49	-	50	28	51	50	74	1	97	18	15	20	-	456
Air valves in same,	25	111	3	42	7	36	40	33	-	10	1	-	-	-	308

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[1] Includes 2,035 feet of 76-inch concrete-lined pressure tunnel and 363 feet of 76-inch mortar-lined and concrete-covered steel pipe and 21 feet of 76-inch cast-iron pipe.

[2] Includes 11,180 feet of 30-inch mortar-lined and covered wrought-iron pipe.

[3] 101.73 miles.

TABLE NO. 42. — *Statement of Cast-iron Hydrant, Blow-off and Drain Pipes, owned and operated by Metropolitan Water and Sewerage Board, Dec. 31, 1912.*

	DIAMETER OF PIPES IN INCHES.								Total.
	24	20	16	12	10	8	6	4	
Total length in use Dec. 31, 1912 (feet), ...	352	293	2,371	4,816	173	351	3,147	1,439	12,942[1]
Total valves in use Dec. 31, 1912, ...	-	-	22	87	1	2	76	44	232

[1] 2.45 miles.

TABLE NO. 43. — *Length of Water Pipes, Four Inches in Diameter and Larger, in the Several Cities and Towns supplied by the Metropolitan Water Works, Dec. 31, 1912.*

BY WHOM OWNED.	INCHES.																				TOTALS.	
	60	48	42	40	36	30	28	24	20	18	16	14	13	12	10	8	7	6	5	4	Feet.	Miles.
Metropolitan Water Works, . .	29,334	182,696	8,075	-	50,970	27,615	-	70,253	67,497	-	67,444	26	-	26,662	3,768	1,841	-	945	-	8	537,134	101.73
Boston,[1] . .	-	39,184	16,813	23,104	47,993	97,599	244	77,482	95,021	-	228,211	5,639	-	1,314,660	246,024	710,654	-	1,343,358	-	118,515	4,364,501	826.61
Somerville, . .	-	-	-	-	-	-	-	-	3,718	367	4,021	7,953	-	84,713	52,809	102,250	-	207,114	-	20,388	483,333	91.54
Malden, . .	-	-	-	-	-	-	-	-	-	-	-	9,155	-	73,090	29,141	79,396	-	216,128	-	60,191	467,101	88.47
Chelsea, . .	-	-	-	-	-	-	-	-	-	-	5,176	-	-	4,974	39,820	28,093	-	139,691	-	7,005	224,759	42.57
Everett, . .	-	-	-	-	-	-	-	2,484	2,900	-	5,204	2,303	-	5,570	41,732	23,339	-	140,696	-	30,600	254,828	48.26
Quincy, . .	-	-	-	-	-	-	-	-	2,679	-	23,232	-	-	27,580	38,072	111,522	994	313,185	948	106,215	624,427	118.26
Medford, . .	-	-	-	-	-	-	-	-	673	-	6,775	9,598	-	27,026	38,557	83,236	-	124,220	-	28,915	319,000	60.42
Melrose, . .	-	-	-	-	-	-	-	-	-	-	5,223	2,920	-	22,156	19,846	24,249	-	139,455	-	53,085	266,934	50.55
Revere,[2] . .	-	-	-	-	-	-	-	-	-	-	23,265	5,725	975	20,823	16,909	23,971	-	71,868	-	76,662	240,198	45.49
Watertown, . .	-	-	-	-	-	-	-	-	-	-	400	11,877	-	5,959	10,172	20,371	-	119,374	-	12,666	180,819	34.25
Arlington, . .	-	-	-	-	-	-	-	-	-	-	-	-	-	24,136	27,188	34,941	-	106,712	-	12,841	205,818	38.98
Milton, . . .	-	-	-	-	-	-	-	-	-	-	103	44	-	22,548	20,935	51,826	-	134,053	-	17,035	246,544	46.69
Winthrop, . .	-	-	-	-	-	-	-	-	-	-	-	-	-	4,049	23,941	31,213	-	44,232	-	59,544	162,979	30.87
Stoneham, . .	-	-	-	-	-	-	-	-	-	-	-	-	-	4,525	4,725	4,543	-	102,287	-	15,642	131,722	24.95
Belmont, . .	-	-	-	-	-	-	-	-	-	-	-	-	-	1,771	14,324	22,240	-	88,472	-	235	127,042	24.06
Lexington, . .	-	-	-	-	-	-	-	-	-	-	-	-	-	9,000	4,879	30,539	-	90,934	-	29,530	164,882	31.23
Nahant, . .	-	-	-	-	-	-	-	-	-	-	-	4,000	-	150	11,555	4,800	-	36,800	-	56,700	114,005	21.59
Swampscott, .	-	-	-	-	-	-	-	-	-	-	-	-	-	7,390	18,176	6,428	-	61,292	-	9,025	102,311	19.38
Total feet, .	29,334	221,880	24,888	23,104	98,963	125,214	244	150,219	172,488	367	369,054	59,240	975	1,686,782	662,573	1,395,452	994	3,480,816	948	714,802	9,218,337	-
Total miles, .	5.55	42.02	4.71	4.38	18.74	23.71	0.05	28.45	32.67	0.07	69.90	11.22	0.18	319.47	125.49	264.29	0.19	659.25	0.18	135.38	-	1,745.90

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[1] Includes Hyde Park.

[2] Includes small portion of Saugus.

TABLE No. 44. — *Number of Service Pipes, Meters and Fire Hydrants in the Several Cities and Towns supplied by the Metropolitan Water Works, Dec. 31, 1912, and the Number of Services and Meters installed during the Year 1912.*

CITY OR TOWN.	Services.	Meters.	Fire Hydrants.	Services Installed.	Meters Installed.
Boston,	99,270	34,565	8,592	4,467[1]	8,962[2]
Somerville,	12,596	7,171	1,158	362	724
Malden,	7,672	7,400	509	59	126
Chelsea,	4,682	4,574	359	190	322
Everett,	5,579	1,891	559	121	332
Quincy,	8,176	6,130	925	436	1,331
Medford,	4,793	4,764	589	236	224
Melrose,	3,699	3,949	334	91	91
Revere,[3]	3,809	1,605	228	189	337
Watertown,	2,251	2,233	347	100	103
Arlington,	2,105	1,957	423	134	421
Milton,	1,587	1,587	378	83	83
Winthrop,	2,655	2,586	241	102	99
Stoneham,	1,501	1,105	144	27	284
Belmont,	1,135	1,135	203	130	127
Lexington,	961	752	153	80	137
Nahant,	590	336	83	35	52
Swampscott,	1,627	1,627	153	92	92
Totals,	164,688	85,367	15,378	6,934[1]	13,847[2]

Includes, [1] 2,562 services and [2] 1,540 meters acquired by the annexation of Hyde Park.

[3] Includes small portion of Saugus.

TABLE NO. 45. — *Average Maximum and Minimum Monthly Heights, in Feet, above Boston City Base, to which Water rose at Different Stations on the Metropolitan Water Works in 1912.*

1912.	LOW SERVICE.														SOUTHERN HIGH SERVICE.			
	BOSTON ENGINE HOUSE, BULFINCH STREET.		ALLSTON ENGINE HOUSE, HARVARD STREET.		MEDFORD, MYSTIC RESERVOIR.		MEDFORD CITY HALL ANNEX, HIGH STREET.		SOMERVILLE CITY HALL ANNEX, WALNUT STREET.		MALDEN WATER WORKS SHOP, GREEN STREET.		CHELSEA COURT HOUSE.		BOSTON METROPOLITAN WATER WORKS OFFICE, 1 ASHBURTON PLACE.		WATERTOWN WATER WORKS OFFICE, MAIN STREET.	
MONTH.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
January, .	151	130	180	173	167	163	167	163	167	161	165	162	162	155	246	233	262	259
February, .	151	131	181	172	167	164	167	163	167	162	165	162	162	154	245	231	262	255
March, .	160	140	177	170	167	164	167	163	167	162	166	163	165	156	248	233	263	258
April, . .	163	143	175	168	166	164	166	161	167	163	166	162	166	158	248	234	263	258
May, . .	163	140	175	169	166	164	166	161	167	163	166	163	166	158	248	233	264	258
June, . .	165	139	178	171	168	165	168	164	167	163	166	163	166	156	246	228	261	250
July, . .	162	139	177	171	168	164	168	163	167	162	166	163	166	156	246	231	261	250
August, .	164	141	177	169	167	164	167	163	166	161	164	162	164	155	248	233	262	257
September, .	166	140	179	171	168	165	167	164	167	163	165	162	165	155	247	232	262	256
October, .	160	138	175	166	167	162	167	162	166	160	165	159	164	154	247	229	263	257
November, .	162	141	179	170	169	163	168	163	169	163	165	161	165	157	248	233	264	260
December, .	160	138	174	167	166	163	166	162	167	162	165	161	165	158	248	234	264	259
Averages, .	161	138	177	170	167	164	167	163	167	162	165	162	165	156	247	232	263	256

TABLE No. 45. — *Average Maximum and Minimum Monthly Heights, in Feet, above Boston City Base, etc.* — Concluded.

1912. MONTH.	SOUTHERN HIGH SERVICE — Concluded.								NORTHERN HIGH SERVICE.										NORTHERN EXTRA HIGH SERVICE.	
	BELMONT WATER WORKS SHOP, WAVERLEY STREET.		MILTON WATER WORKS OFFICE, ADAMS STREET.		FORBES HILL TOWER, QUINCY.		QUINCY WATER WORKS SHOP.		SOMERVILLE PUMPING STATION, CEDAR STREET.		MALDEN CITY HALL.		REVERE WATER WORKS OFFICE, BROADWAY.		LYNN ENGINE HOUSE, UNION SQUARE.		WINTHROP TOWN HALL, HERMAN STREET.		LEXINGTON TOWN HALL, MASSACHUSETTS AVENUE.	
	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
January, .	261	252	247	235	239	226	238	213	267	249	269	265	264	256	260	254	187	174	387	371
February, .	261	250	246	230	236	221	233	199	267	248	267	264	263	254	259	251	192	173	386	367
March, . .	263	252	248	234	239	226	238	215	268	250	269	265	267	258	263	258	194	180	386	370
April, . .	262	249	249	233	240	225	237	211	270	251	271	266	269	259	266	259	198	188	386	368
May, . .	263	249	247	232	239	224	236	214	268	248	267	262	268	257	262	253	199	188	381	367
June, . .	260	229	246	227	238	218	234	204	268	240	266	261	261	248	255	235	198	180	380	365
July, . .	261	233	251	233	243	221	237	204	267	238	267	259	263	246	254	225	200	176	383	369
August, .	263	248	253	238	245	230	241	214	267	251	269	262	264	252	259	240	196	175	383	376
September, .	263	248	251	238	244	230	239	215	267	250	270	263	265	255	261	253	191	178	371	362
October, .	262	247	249	230	241	223	236	209	267	248	272	264	268	257	268	253	195	182	385	374
November, .	263	252	249	234	242	226	236	213	267	251	270	263	268	260	268	257	195	184	416[1]	399[1]
December, .	263	251	248	236	244	231	240	221	270	252	271	264	269	260	268	256	194	182	430[1]	413[1]
Averages, .	262	247	249	233	241	225	237	211	268	248	269	263	266	255	262	250	195	180	390	375

[1] Direct pressure from November 11.

APPENDIX No. 3.

WATER WORKS STATISTICS FOR THE YEAR 1912.

The Metropolitan Water Works supply the Metropolitan Water District which includes the following cities and towns: —

CITY OR TOWN.	Population, Census of 1910.	Estimated Population, July 1, 1912.
Boston,	670,585	718,900
Somerville,	77,236	81,080
Malden,	44,404	46,840
Chelsea,	32,452	34,720
Newton,[1]	39,806	41,780
Everett,	33,484	36,110
Quincy,	32,642	34,640
Medford,	23,150	24,880
Hyde Park,	15,507	–[2]
Melrose,	15,715	16,350
Revere,	18,219	19,980
Watertown,	12,875	13,700
Arlington,	11,187	12,120
Milton,	7,924	8,300
Winthrop,	10,132	11,050
Stoneham,	7,090	7,600
Swampscott,	6,204	6,520
Lexington,	4,918	5,240
Belmont,	5,542	6,080
Nahant,	1,184	1,320
Total population of Metropolitan Water District,	1,070,256	1,127,210
Saugus,[3]	280	280

[1] No water supplied during the year from Metropolitan Water Works.
[2] Included in Boston.
[3] Only a small portion of Saugus is supplied with water.

Mode of Supply.

31 per cent. by gravity.
69 per cent. by pumping.

Pumping.

Chestnut Hill Pumping Station No. 1: —

Builders of pumping machinery, Holly Manufacturing Company, Quintard Iron Works and E. P. Allis Company.

Description of coal used: — Bituminous: Beaver Run and Sonman. Anthracite: buckwheat and screenings. Price per gross ton in bins: bituminous $4.04 to $4.05, buckwheat $2.86, screenings $3.08. Average price per gross ton $4.02. Per cent. ashes 10.7.

Chestnut Hill Pumping Station No. 2: —

Builders of pumping machinery, Holly Manufacturing Company.

Description of coal used: — Bituminous: Beaver Run and Sonman. Price per gross ton in bins: bituminous $3.89 to $3.93. Average price per gross ton $3.91. Per cent. ashes 10.0.

Spot Pond Station: —

Builders of pumping machinery, Geo. F. Blake Manufacturing Company and Holly Manufacturing Company.

Description of coal used: — Bituminous: Pocahontas and New River. Anthracite: screenings. Price per gross ton in bins: bituminous $4.39 to $4.76, screenings $2.50. Average price per gross ton $4.42. Per cent. ashes 10.7.

	CHESTNUT HILL PUMPING STATIONS —			
	No. 1.			No. 2.
	Engines Nos. 1 and 2.	Engine No. 3.	Engine No. 4.	Engine No. 12.
Daily pumping capacity (gallons),	16,000,000	20,000,000	30,000,000	40,000,000
Coal consumed for year (pounds),	1,381,720	21,735	4,034,529	4,069,092
Cost of pumping, figured on pumping station expenses,	$5,874.72	$102.45	$17,815.30	$16,571.32
Total pumpage for year, corrected for slip (million gallons).	942.55	22.33	5,719.05	6,035.32
Average dynamic head (feet),	133.96	118.09	120.93	123.61
Gallons pumped per pound of coal,	682.16	1,027.38	1,417.53	1,483.21
Duty on basis of plunger displacement,	78,490,000	105,700,000	145,660,000	155,820,000
Cost per million gallons raised to reservoir,	$6.2328	$4.5880	$3.1151	$2.7457
Cost per million gallons raised one foot,	.0465	.0398	.0257	.0222

	CHESTNUT HILL PUMPING STATION No. 2.	SPOT POND STATION.
	Engines Nos. 5, 6 and 7.	Engines Nos. 8 and 9.
Daily pumping capacity (gallons),	105,000,000	30,000,000
Coal consumed for year (pounds),	6,220,263	2,577,635
Cost of pumping figured on pumping station expenses,	$34,210.17	$16,042.06
Total pumpage for year, corrected for slip (million gallons),	16,561.43	2,938.92
Average dynamic head (feet),	46.04	127.84
Gallons pumped per pound of coal,	2,662.50	1,140.16
Duty on basis of plunger displacement,	104,200,000	123,890,000
Cost per million gallons raised to reservoir,	$2.0657	$5.4585
Cost per million gallons raised one foot,	.0449	.0427

Consumption.

Estimated total population of the nineteen cities and towns supplied wholly or partially during the year 1912,	1,086,690
Total consumption (gallons), pump basis,	42,388,000,000
Average daily consumption (gallons), pump basis,	115,814,000
Gallons per day to each inhabitant, pump basis,	106.6

Distribution.

	Owned and operated by Metropolitan Water and Sewerage Board.	Total in District supplied by Metropolitan Water Works.
Kinds of pipe used,	–[1]	–[2]
Sizes,	60 to 4 inch.	60 to 4 inch.
Extensions, less length abandoned (miles),	0.15	74.40
Length in use (miles),	101.73	1,745.90
Stop gates added,	3	–
Stop gates now in use,	456	–
Service pipes added,	–	6,319[3]
Service pipes now in use,	–	164,638
Meters added,	–	13,335[4]
Meters now in use,	–	85,360
Fire hydrants added,	–	660
Fire hydrants now in use,	–	15,378

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[1] Cast-iron, cement-lined wrought iron and cement-lined steel pipe.

[2] Cast-iron, cement-lined wrought iron, cement-lined steel and kalamine pipe.

Includes [3] 2,562 services and [4] 1,540 meters acquired by the annexation of Hyde Park to Boston.

APPENDIX No. 4.

CONTRACTS MADE AND PENDING DURING

Contracts relating to the

	1. Number of Contract.	2. WORK.	3. Number of Bids.	AMOUNT OF BID.		6. Contractor.
				4. Next to Lowest.	5. Lowest.	
1	73[1]	Additions to the pumping plant at East Boston.	1	-	$37,000 00[2]	Allis-Chalmers Co., Milwaukee, Wis.
2	81[1]	Section 66, extension of North Metropolitan System in Broadway, Malden to Everett.	8	$16,531 38	16,184 00[2]	A. G. Tomasello, Boston.
3	90[1]	4,250 tons of coal: — 2,900 tons for East Boston pumping station. 1,000 tons for Charlestown pumping station. 350 tons for Alewife Brook pumping station.	 3 3 2	 $3.79 per ton. $3.86 per ton. $4.60 per ton.	 $3.725 per ton.[2] $3.725 per ton.[2] $4.35 per ton.[2]	New England Coal and Coke Co., Boston.
4	91[1]	2,600 tons of coal for Deer Island pumping station.	4	$3.92 per ton.	$3.92 per ton.[2]	Staples Coal Co., Boston.
5	94[1]	Basin at wharf at East Boston pumping station.	1	-	$375 00	Bay State Dredging Co., Boston.
6	95	425 tons of coal for Alewife Brook pumping station.	2	$4.85 per ton.	$4.60 per ton.[2]	Locke Coal Co., Malden.
7	96	6,600 tons of coal: — 2,600 tons for Deer Island pumping station. 3,000 tons for East Boston pumping station. 1,000 tons for Charlestown pumping station.	 3 3 3	 $4.18 per ton. $4.03 per ton. $4.08 per ton.	 $3.98 per ton.[2] $3.98 per ton.[2] $3.98 per ton.[2]	Metropolitan Coal Co., Boston.
8	99	Section 67, New Mystic Sewer, North Metropolitan System in Medford and Winchester.	7	$104,575 00	$93,090 00[2]	Coleman Bros., Chelsea.
9	100	Extension of screen-house at East Boston pumping station.	9	4,782 00	4,700 00[2]	J. E. Locatelli & Co., Boston.

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[1] Contract completed.

APPENDIX No. 4.

THE YEAR 1912 — SEWERAGE WORKS.

North Metropolitan System.

7. Date of Contract.	8. Date of Completion of Work.	9. Prices of Principal Items of Contracts made in 1912.	10. Value of Work done Dec. 31, 1912.	
June 5, 1909	Dec. 27, 1911	- -	$37,000 00	1
July 27, 1910	Dec. 6, 1911	- -	23,056 44	2
July 5, 1911	July 1, 1912	- -	16,277 51	3
July 5, 1911	July 1, 1912	- -	10,249 52	4
April 6, 1912	April 9, 1912	Dredging and removing material from vicinity of wharf at East Boston pumping station.	375 00	5
June 5, 1912	-	$4.60 per ton of 2,240 lbs. delivered in bins at Alewife Brook pumping station.	541 14	6
June 5, 1912	-	$3.98 per ton of 2,240 lbs. delivered in bins at Deer Island pumping station. $3.98 per ton of 2,240 lbs. delivered in bins at East Boston pumping station. $3.98 per ton of 2,240 lbs. delivered in bins at Charlestown pumping station.	10,494 73	7
Oct. 15, 1912	-	For earth excavation and refilling in trench for 54-inch concrete sewer and connections, $9 per lin. ft.; for earth or rock excavation and refilling in tunnel for 54-inch concrete sewer, $15 per lin. ft.; for Portland cement brick masonry in shafts, manholes and special structures, $18 per cu. yd.; for Portland cement concrete masonry in trench, $7 per cu. yd.; for Portland cement concrete in tunnel, $10 per cu. yd.; for rock excavation in trench, $3 per cu. yd.	15,038 50	8
Dec. 26, 1912	-	Extension of screen-house at East Boston pumping station.	-	9

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[2] Contract based upon this bid.

CONTRACTS MADE AND PENDING DURING

Contracts relating to the

	1. Number of Contract.	2. WORK.	3. Number of Bids.	AMOUNT OF BID. 4. Next to Lowest.	AMOUNT OF BID. 5. Lowest.	6. Contractor.
1	91[1]	2,350 tons of coal: —				Staples Coal Co., Boston.
		1,900 tons for Ward Street pumping station.	4	$3.95 per ton.	$3.92 per ton.[2]	
		450 tons for Nut Island screen-house.	3	$4.03 per ton.	$4.02 per ton.[2]	
2	92[1]	375 tons of coal for Quincy pumping station.	3	$4.75 per ton.	$4.45 per ton.[2]	Neponset Coal Co., Dorchester.
3	97	2,700 tons of coal: —				Metropolitan Coal Co., Boston.
		2,200 tons for Ward Street pumping station.	3	$4.40 per ton.	$4.31 per ton.[2]	
		500 tons for Nut Island screen-house.	2	$4.37 per ton.	$4.12 per ton.[2]	
4	98	475 tons of coal for Quincy pumping station.	2	$4.74 per ton.	$4.65 per ton.[2]	City Fuel Co., Boston.

[1] Contract completed.

THE YEAR 1912 — SEWERAGE WORKS — *Continued.*

South Metropolitan System.

7. Date of Contract.	8. Date of Completion of Work.	9. Prices of Principal Items of Contracts made in 1912.	10. Value of Work done Dec. 31, 1912.	
July 5, 1911	July 1, 1912	- -	$10,357 04	1
July 5, 1911	July 1, 1912	- -	1,977 31	2
June 5, 1912	-	$4.31 per ton of 2,240 lbs. delivered in bins at Ward Street pumping station. $4.12 per ton of 2,240 lbs. delivered on wharf at Nut Island screen-house.	5,112 56	3
June 5, 1912	-	$4.65 per ton of 2,240 lbs. delivered in bins at Quincy pumping station.	539 29	4

[2] Contract based upon this bid.

CONTRACTS MADE AND PENDING DURING THE YEAR 1912 — SEWERAGE WORKS — *Concluded.*

Summary of Contracts.

	Value of Work done Dec. 31, 1912.
North Metropolitan System, 9 contracts,	$113,032 84
South Metropolitan System, 4 contracts,	17,986 20
Total of 13 contracts made and pending during the year 1912,	$131,019 04

APPENDIX No. 5.

METROPOLITAN SEWERAGE WORKS.

NORTH METROPOLITAN SEWERAGE SYSTEM.

TABLE No. 1. — *Location, Length and Sizes of Sewers with Public and Special Connections.*

City or Town.	Size of Sewers.	Length in Miles.	Public Connections, December 31, 1912.	Special Connections.	
				Character or Location of Connection.	Number in Operation.
Boston: —					
Deer Island,	6′ 3″ to 9′,	1.367	4	– –	–
East Boston,	9′ to 1′,	5.467	24	Shoe factory,	1
Charlestown,	6′ 7″×7′ 5″ to 1′,	3.292	14	Navy Yard, Almshouse, Private Building,	8 1 1
Winthrop,	9′,	2.864	12	Club House, Fire Dept. Station, Private Building,	1 1 1
Chelsea,	8′ 4″×9′ 2″ to 1′ 10″×2′ 4″,	5.123	10	Bakery, Rendering works, Metropolitan Water Works blow-off, Chelsea Water Works blow-off,	1 1 1 2
Everett,	8′ 2″×8′ 10″ to 4′ 8″×5′ 1″,	2.925	6	Metropolitan Water Works blow-off, Cameron Appliance Co., Shultz-Goodwin Co., Andrews-Wasgatt Co., National Metallic Bed Co., Linoide Co.,	1 1 1 1 1 1
Malden,	4′ 6″×4′ 10″ to 1′,	5.844[1]	31	Metropolitan Water Works blow-off, Private buildings,	1 164
Melrose,	4′ 6″×4′ 10″ to 10″,	6.099[2]	36	Private buildings, Factory, Railroad station,	111 1 1
Cambridge,	5′ 2″×5′ 9″ to 1′ 3″,	7.167	38	Slaughter house, City Hospital, Street Railway Machine Shop, Tannery,	1 2 1 1
Somerville,	6′ 5″×7′ 2″ to 1′ 10″×2′ 3″,	3.471	10	Slaughter-houses (3), Car-house, Somerville Water Works blow-off, Street railway power house, Stable, Rendering works,	1 1 1 1 1 1
Medford,	4′ 8″×5′ 1″ to 10″,	5.359	22	Armory building, Private buildings, Stable, Police sub-station,	1 8 1 1

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[1] Includes 1.84 of a mile of sewer purchased from the city of Malden.

[2] Includes .736 of a mile of sewer purchased from the city of Melrose.

TABLE No. 1. — *Location, Length and Sizes of Sewers with Public and Special Connections* — Concluded.

CITY OR TOWN.	Size of Sewers.	Length in Miles.	Public Connections, December, 31, 1912.	SPECIAL CONNECTIONS.	
				Character or Location of Connections.	Number in Operation.
Winchester,	4′ 6″ to 1′ 3″,	6.518	14	Tannery,	4
				Private buildings,	3
				Gelatine factory,	1
				Stable,	1
				Railroad station,	1
Stoneham,	1′ 3″ to 10″,	0.010	4	-	-
Woburn,	1′ 10″×2′ 4″ to 1′ 3″,	0.933	3	Glue factory,	1
Arlington,	1′ 6″ to 10″,	3.520[1]	37	Private buildings,	136
				Railroad station,	1
				Car-house,	3
				Post Office,	1
Belmont,[2]	-	-	3	-	-
Wakefield,[2]	-	-	1	-	-
Revere,	4′ to 3′,	0.048	2	-	-
		60.007[3]	271		477

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[1] Includes 2.631 miles of sewer purchased from the town of Arlington.

[2] The Metropolitan sewer extends but a few feet into the towns of Belmont and Wakefield.

[3] Includes 2.787 miles of Mystic valley sewer in Medford, Winchester and Woburn, running parallel with the Metropolitan sewer.

SOUTH METROPOLITAN SEWERAGE SYSTEM.

TABLE NO. 2. — *Location, Length and Sizes of Sewers with Public and Special Connections.*

CITY OR TOWN.	Size of Sewers.	Length in Miles.	Public Connections, December 31, 1912.	SPECIAL CONNECTIONS.	
				Character or Location of Connection.	Number in Operation.
Boston (Back Bay),	6' 6" to 3' 9",	1.500[1]	13	Tufts Medical School, Private house, Administration Building, Boston Park Department, Simmons College buildings, Art Museum,	1 1 1 1 2
Boston (Brighton),	5' 9"X6' 0" to 12",	6.010[2]	14	Abattoir,	3
Boston (Dorchester).	3'X4' to 2' 6"X2' 7",	2.870[3]	12	Chocolate works, Machine shop, Paper mill, Private buildings,	2 1 1 3
Boston (Roxbury),	6' 6"X7", 4' 0",	1.430	–	– –	–
Boston (West Roxbury).	9' 3"X10' 2" to 12",	7.600	12	Parental school, Lutheran Evangelical Church, Private buildings,	1 1 4
Brookline,	6' 6"X7' 0" to 8",	2.540[4]	12	– –	–
Dedham,	4'X4' 1" to 3' 9"X3' 10",	2.350	6	– –	–
Hull,	60" pipe,	0.750	–	– –	–
Boston (Hyde Park),	10' 7"X11' 7" to 4'X4' 1",	4.527	17	Mattapan Paper Mills, Private buildings,	1 2
Milton,	11'X12' to 8",	3.600	20	Private buildings,	2
Newton,	4' 2"X4' 9" to 1' 3",	2.911	6	Private houses,	2
Quincy,	11' 3"X12' 6" to 24" pipe,	6.580	12	– –	–
Waltham,	3' 6"X4',	0.001	1	– –	–
Watertown,	4' 2"X4' 9" to 12",	0.750[5]	5	Factories, Stanley Motor Carriage Co., Knights of Pythias Building,	2 1 1
		43.419	130		33

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[1] Includes .355 of a mile of sewer purchased from the city of Boston.

[2] Includes .446 of a mile of pipe and concrete sewers built for the use of the city of Boston; also, .026 of a mile of sewer purchased from the town of Watertown.

[3] Includes 1.24 miles of sewer purchased from the city of Boston.

[4] Includes .158 of a mile of pipe sewer built for the use of the town of Brookline.

[5] Includes .025 of a mile of sewer purchased from the town of Watertown.

NORTH METROPOLITAN SEWERAGE SYSTEM.

TABLE NO. 3. — *Table showing Cities and Towns delivering Sewage in this System; Approximate Miles of Sewer connected; Estimated Populations and Areas now contributing; Total Areas ultimately to contribute, and Present Populations on Such Areas; Ratios of Present Contributing Areas to Ultimate Areas, and Ratios of Populations now contributing to Present Total Populations.*

[Populations estimated as of December 31, 1912.]

CITIES AND TOWNS.	Miles of Local Sewer connected.	Separate or Combined.	Number of Connections with Local Sewers.	Estimated Number of Persons served by Each House Connection.[1]	Estimated Population now contributing Sewage.	Estimated Present Total Population.	Estimated Area now contributing Sewage.	Area ultimately to Contribute Sewage.	Ratio of Contributing Population to Present Total Population.	Ratio of Contributing Area to Ultimate Area.
							Sq. Miles.	Sq. Miles.	Per Cent.	Per Cent.
Boston (Deer Island), .	0.70	Separate, ...	–	–	1,200[2]	1,200[2]	–	–	100.0	–
Winthrop, ...	31.26	Separate, ...	2,609	4.25	11,090	11,240	1.36	1.61	98.6	84.5
Boston (East Boston), .	31.51	Separate and combined,	4,860	12.40	60,265	62,930	1.11	2.18	95.8	50.9
Chelsea, ...	29.67[3]	Separate and combined,	3,715[4]	9.10	33,805	35,260	1.11	2.24	95.9	49.6
Everett, ...	45.84	Separate and combined,	4,584	6.80	31,170	36,710	1.95	3.34	84.9	58.4
Malden, ...	59.76	Separate, ...	6,064	6.30	38,205	47,370	2.94	5.07	80.6	58.0
Melrose, ...	36.80	Separate, ...	2,944	4.60	13,540	16,490	1.78	3.73	82.1	47.7
Boston (Charlestown), .	21.16	Separate and combined,	5,326	7.85	41,810	42,250	0.67	1.27	99.0	52.8
Cambridge, ...	147.26	Separate and combined,	15,872	6.75	107,135	108,700	5.01	6.11	98.6	82.0
Somerville, ...	97.56	Separate and combined,	14,815	5.45	80,740	81,940	3.40	3.96	98.5	85.9
Medford, ...	56.61	Separate, ...	4,511	5.50	24,810	25,270	2.99	8.35	98.2	35.8
Winchester, ...	25.81	Separate, ...	1,444	5.50	7,940	9,940	1.29	5.95	79.9	21.7
Woburn, ...	14.35[5]	Separate, ...	1,104	5.80	6,405	15,930	0.96	12.71	40.2	7.6
Stoneham, ...	13.05	Separate, ...	824	5.00	4,120	7,720	0.68	5.50	53.4	12.4
Arlington, ...	25.45	Separate, ...	1,523	6.10	9,290	12,330	1.77	5.20	75.3	34.0
Belmont, ...	15.61	Separate, ...	740	6.30	5,160[6]	6,200	1.13	4.66	83.2	24.3
Wakefield, ...	12.44	Separate, ...	639	5.60	3,580	12,030	0.49	7.65	29.8	6.4
Lexington,[7]	–	– –	–	–	–	4,280	–	5.11	–	–
Revere, ...	35.41	Separate, ...	2,802	5.90	16,530	20,350	1.87	5.86	81.2	31.9
Totals, ...	700.25	– –	74,376	6.70	496,795	558,140	30.51	90.50	89.0	33.7

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[1] Estimated from assessors' statement of the number of houses in each city or town, on April 1, 1912, and the population from census of 1910.

[2] Estimated by Superintendent James H. Cronin of the Institution on Deer Island.

[3] The districts connecting at Cypress Street, Revere Beach Parkway, Springvale Avenue, Willoughby, Bellingham, Highland, Hawthorn and Spruce streets are now contributing sewage.

[4] Estimated.

[5] Exclusive of Mystic valley sewer and tanneries.

[6] Including 2 connections with McLean Hospital, having an estimated population of 495.

[7] Lexington not connected.

SOUTH METROPOLITAN SEWERAGE SYSTEM.

TABLE NO. 4. — *Table showing Cities and Towns delivering Sewage to this System; Approximate Miles of Sewer connected; Estimated Populations and Areas now contributing; Total Areas ultimately to contribute, and Present Populations on Such Areas; Ratios of Present Contributing Areas to Ultimate Areas, and Ratios of Populations now contributing to Present Total Populations.*

[Populations estimated as of December 31, 1912.]

CITIES AND TOWNS.	Miles of Local Sewer connected.	Separate or Combined.	Number of Connections with Local Sewers.	Estimated Number of Persons served by Each House Connection.[1]	Estimated Population now contributing Sewage.	Estimated Present Total Population.	Estimated Area now contributing Sewage.	Area ultimately to Contribute Sewage.	Ratio of Contributing Population to Present Total Population.	Ratio of Contributing Area to Ultimate Area.
							Sq. Miles.	Sq. Miles.	Per Cent.	Per Cent.
Boston (Back Bay), .	24.99	Separate and combined,	1,652	17.10	28,250	28,780	1.24	1.61	98.2	77.0
Boston (Brighton), .	58.03	Separate and combined,	3,251	6.30	20,480	29,680	3.17	3.74	69.0	84.8
Brookline, ...	67.88	Separate and combined,	3,980	7.25	28,855	30,010	3.47	6.81	96.2	51.0
Newton, ...	115.33	Separate, . . .	6,280	6.00	37,680	42,230	7.32	16.88	89.2	43.4
Watertown, ...	38.10	Separate, . . .	2,003	5.40	10,815	13,880	2.05	4.04	77.9	50.7
Waltham, ...	44.17	Separate, . . .	3,577	7.65	27,365	29,460	2.27	13.63	92.9	16.7
Boston (Dorchester), .	51.81	Separate and combined,	5,089	7.70	39,185	65,900	2.41	4.89	59.5	49.5
Milton, ...	11.32	Separate and combined,	612	5.40	3,305	8,380	0.71	12.59	39.4	5.6
Boston (Hyde Park), .	27.66	Separate, . . .	1,963	7.00[2]	13,740	16,440	1.33	4.57	83.6	29.1
Dedham, ...	15.63	Separate, . . .	640	5.00	3,200	9,600[3]	0.78	9.40	33.3	8.3
Boston (Roxbury), .	–	– –	–	–	–	42,200	–	1.23	–	–
Boston (West Roxbury),	50.57	Separate and combined,	3,158	5.80	19,740[4]	30,200	2.39	8.92	65.4	26.8
Quincy, ...	66.91	Separate, . . .	4,010	4.90	19,650	35,080	2.98	12.56	56.0	23.7
Totals, . . .	572.40	– –	36,215	7.00	252,265	381,840	30.12	100.87	66.1	29.9

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[1] Estimated from assessors' statement of the number of houses in each city or town, on April 1, 1912, and the population from census of 1910.

[2] Estimated by Town Engineer.

[3] Part of town not included in Metropolitan Sewerage District.

[4] Including connection with Institution at Austin Farm, having an estimated population of 1,425.

APPENDIX NO. 6.

FINANCIAL STATEMENT PRESENTED TO THE GENERAL COURT ON JANUARY 8, 1913.

The Metropolitan Water and Sewerage Board respectfully presents the following abstract of the account of its doings, receipts, expenditures, disbursements, assets and liabilities for the year ending November 30, 1912, in accordance with the provisions of chapter 235 of the Acts of the year 1906.

METROPOLITAN WATER WORKS.

Construction.

The loans authorized for expenditures under the Metropolitan Water acts, the receipts which are added to the loan fund, the expenditures for the construction and acquisition of works, and the balance available on December 1, 1912, have been as follows: —

Loans authorized under Metropolitan Water acts,		$42,690,000 00
Receipt from town of Swampscott for admission to Metropolitan Water District, paid into Loan Fund (St. 1909, c. 320),		90,000 00
Receipts from the sales of property which are placed to the credit of the Metropolitan Water Loan Fund: —		
For the year ending November 30, 1912,	$20,382 62	
For the period prior to December 1, 1911,	200,453 52	
		220,836 14
		$43,000,836 14
Amount approved for payment by the Board out of the Metropolitan Water Loan Fund: —		
For the year ending November 30, 1912,	$104,894 17	
For the period prior to December 1, 1911,	41,925,028 48	
		42,029,922 65
Balance December 1, 1912,		$970,913 49

The amount of the Metropolitan Water Loan bonds issued and outstanding at the beginning of the fiscal year was $41,738,000. At the end of the year the amount of the bonds issued was $41,788,000.

The Metropolitan Water Loan Sinking Fund amounted at the beginning of the year to $8,927,838.95, and at the end of the year to $9,811,181.29. The net decrease in the debt for the Metropolitan Water Works was $833,342.34.

Maintenance.

Amount appropriated for the maintenance and operation of works, for the year ending November 30, 1912,	$426,000 00	
Balance of special appropriation for the improvement of the Cochituate watershed (1909–1911) remaining,	1,441 98	
Special appropriation for protection of water supply (1911),	15,000 00	
Receipts credited to this fund for year ending November 30, 1912,	86,691 67	
		$529,133 65
Amount approved by Board for maintenance and operation of works during year ending November 30, 1912,		451,529 16
Balance December 1, 1912,		$77,604 49

This balance includes the sum of $1,117.12 appropriated for the improvement of the Cochituate watershed which remains to be expended for the completion of the work. There are also included in the balance the sum of $14,921.21, the amount remaining unexpended of the special appropriation for the protection of the water supply in Newton, and the sum of $20,000, the special appropriation in 1912 for the protection and improvement of the water supply especially in the town of Framingham.

The Board has also received during the year ending November 30, 1912, $95,835.44 from rentals, the sale of land, land products and power and from other proceeds from the operations of the Board which according to section 18 of the Metropolitan Water Act are applied by the Treasurer of the Commonwealth to the payment of interest on the Metropolitan Water Loan, to sinking fund requirements, and expenses of maintenance and operation of works, in reduction of the amount to be assessed upon the Metropolitan Water District for the year.

Sums received from sales of water to municipalities not belonging to the District and to water companies, and from municipalities for admission to the District, have been applied as follows: —

For the period prior to December 1, 1906, distributed to the cities and towns of the District, as provided by section 3 of the Metropolitan Water Act,	$219,865 65
For the period beginning December 1, 1906, and prior to December 1, 1911, applied to the Metropolitan Water Loan Sinking Fund, as provided by chapter 238 of the Acts of 1907,	26,787 09
For the year beginning December 1, 1911, and ending November 30, 1912, applied to the Metropolitan Water Loan Sinking Fund, as provided by said last-named act,	14,814 54
	$261,467 28

METROPOLITAN SEWERAGE WORKS.

Construction.

The loans authorized under the various acts of the Legislature for the construction of the Metropolitan Sewerage Works, the receipts which are added to the proceeds of the loans, and the expenditures for construction, are given below, as follows: —

North Metropolitan System.

Loans authorized for expenditures for construction under the various acts, including those for the Revere, Belmont and Malden extensions, North System enlargements and extensions, and New Mystic Sewer,	$7,013,865 73	
Receipts from sales of real estate and from miscellaneous sources, which are placed to the credit of the North Metropolitan System: —		
For the year ending November 30, 1912,	10,623 60	
For the period prior to December 1, 1911,	64,560 64	
Amount approved for payment by the Board[1] out of the Metropolitan Sewerage Loan Fund, North System: —		
For the year ending November 30, 1912,		$46,595 23
For the period prior to December 1, 1911,		6,679,862 22
	$7,089,049 97	$6,726,457 45
Balance December 1, 1912,		$362,592 52

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[1] The word "Board" refers to the Metropolitan Sewerage Commission and its successor the Metropolitan Water and Sewerage Board.

South Metropolitan System.

Loans authorized for expenditures for construction under the various acts, applied to the construction of the Charles River valley sewer, Neponset valley sewer, High-level sewer and extension,	$8,867,046 27	
Receipts for pumping, sales of real estate and from miscellaneous sources, which are placed to the credit of the South Metropolitan System: —		
For the year ending November 30, 1912,	372 09	
For the period prior to December 1, 1911,	13,632 51	
Amount approved by the Board for payment as follows: —		
On account of the Charles River valley sewer,		$800,046 27
On account of the Neponset valley sewer,		911,531 46
On account of the High-level sewer and extension: —		
For the year ending November 30, 1912,		7,504 29
For the period prior to December 1, 1911,		7,101,407 03
	$8,881,050 87	$8,820,489 05
Balance December 1, 1912,		$60,561 82

The amount of the Metropolitan Sewerage Loan bonds issued and outstanding at the beginning of the fiscal year was $15,502,912, and at the end of the year the amount so issued and outstanding was the same. Of the total amount outstanding at the end of the year, $6,625,000 was issued for the North Metropolitan System, and $8,877,912 for the South Metropolitan System. The amount of the Metropolitan Sewerage Sinking Fund was at the beginning of the fiscal year $2,180,653.98, and at the end of the year was $2,454,189.72, of which $1,572,485.73 was on account of the North Metropolitan System, and $881,703.99 was on account of the South Metropolitan System. The net decrease in the debt for the Metropolitan Sewerage Works was $273,535.74.

Maintenance.

North Metropolitan System.

Appropriated for the year ending November 30, 1912,	$160,500 00
Receipts from pumping and from other sources, which are returned to the appropriation: —	
For the year ending November 30, 1912,	674 27
	$161,174 27
Amount approved for payment by the Board: —	
For the year ending November 30, 1912,	156,845 07
Balance December 1, 1912,	$4,329 20

South Metropolitan System.

Appropriated for the year ending November 30, 1912,	$107,550 00
Receipts from sales of property and for pumping, which are returned to the appropriation: —	
For the year ending November 30, 1912,	383 99
	$107,933 99
Amount approved for payment by the Board: —	
For the year ending November 30, 1912,	103,716 97
Balance December 1, 1912,	$4,217 02

APPENDIX No. 7.

LEGISLATION OF THE YEAR 1912 AFFECTING THE METROPOLITAN WATER AND SEWERAGE BOARD.

Acts of 1912.

CHAPTER 132.

AN ACT MAKING AN APPROPRIATION FOR OPERATING THE NORTH METROPOLITAN SYSTEM OF SEWAGE DISPOSAL.

Be it enacted, etc., as follows:

Appropriation for maintenance of north metropolitan sewerage works.

SECTION 1. A sum not exceeding one hundred and sixty thousand five hundred dollars is hereby appropriated, to be paid out of the North Metropolitan System Maintenance Fund, for the maintenance and operation of a system of sewage disposal for the cities included in what is known as the north metropolitan system, during the fiscal year ending on the thirtieth day of November, nineteen hundred and twelve.

SECTION 2. This act shall take effect upon its passage. [*Approved February 20, 1912.*

CHAPTER 133.

AN ACT MAKING AN APPROPRIATION FOR OPERATING THE METROPOLITAN WATER SYSTEM.

Be it enacted, etc., as follows:

Appropriation for maintenance of metropolitan water works.

SECTION 1. A sum not exceeding four hundred and twenty-six thousand dollars is hereby appropriated, to be paid out of the Metropolitan Water Maintenance Fund, for the maintenance and operation of the metropolitan water system for the cities and towns in what is known as the metropolitan water district, during the fiscal year ending on the thirtieth day of November, nineteen hundred and twelve.

SECTION 2. This act shall take effect upon its passage. [*Approved February 20, 1912.*

CHAPTER 146.

AN ACT MAKING AN APPROPRIATION FOR OPERATING THE SOUTH METROPOLITAN SYSTEM OF SEWAGE DISPOSAL.

Be it enacted, etc., as follows:

Appropriation for maintenance of south metropolitan sewerage works.

SECTION 1. A sum not exceeding one hundred seven thousand five hundred and fifty dollars is hereby appropriated, to be paid out of the South Metropolitan System Maintenance Fund, for the cost of maintenance and operation of the south metropolitan system of sewage disposal, comprising a part of Boston, the cities of Newton and Waltham, and the towns of Brookline, Watertown, Dedham and Milton, during the fiscal year ending on the thirtieth day of November, nineteen hundred and twelve.

SECTION 2. This act shall take effect upon its passage. [*Approved February 23, 1912.*

CHAPTER 461.

AN ACT TO PROVIDE FOR CERTAIN IMPROVEMENTS IN THE NORTH METROPOLITAN SEWERAGE SYSTEM.

Be it enacted, etc., as follows:

Improvements in the north metropolitan sewerage system.

SECTION 1. The metropolitan water and sewerage board is hereby authorized to provide and construct, as a part of the north metropolitan sewerage system, the following works: — An additional main sewer in the Mystic valley extending from a point in the old Mystic valley sewer near the boundary line between the city of Woburn and the town of Winchester and running through the town of Winchester and a part of the city of Medford to a point in the new metropolitan main sewer near its junction with the Mystic valley main sewer; and new screening machinery in connection with the East Boston sewerage pumping station, with such additional land as may be necessary in connection with the installation of such machinery; and for these purposes the sum of three hundred and seventy-eight thousand dollars shall be allowed and paid out of the treasury of the commonwealth from the Metropolitan Sewerage Loan Fund, North System.

Metropolitan Sewerage Loan.

SECTION 2. For the purposes named in the preceding section the said board may, in addition to providing for works for which expenditures have hitherto been authorized, expend any sum heretofore appropriated for the construction of the metropolitan sewerage works, north system. To meet the further expenditures incurred under the provisions of this act and not so provided for, the treasurer and receiver general shall, from time to time, issue in the name and behalf of the commonwealth and under its seal bonds designated on the face thereof, Metropolitan Sewerage Loan, to an amount not exceeding three hundred and seventy-eight thousand dollars, in addition to the amount of such bonds heretofore authorized for the construction of the north metropolitan sewerage works.

Provisions of law which apply.

SECTION 3. The provisions of chapter four hundred and thirty-nine of the acts of the year eighteen hundred and eighty-nine and of all acts in amendment thereof and in addition thereto shall, so far as they may be applicable, apply to the indebtedness and all proceedings authorized by this act.

SECTION 4. This act shall take effect upon its passage. [*Approved April 10, 1912.*

CHAPTER 528.

AN ACT TO PROVIDE A SATURDAY HALF HOLIDAY FOR LABORERS AND MECHANICS OF THE METROPOLITAN WATER AND SEWERAGE BOARD AND THE METROPOLITAN PARK COMMISSION.

Be it enacted, etc., as follows:

To provide a half holiday for certain laborers, etc.

SECTION 1. Laborers and mechanics in the permanent service of the metropolitan water and sewerage board of the metropolitan park commission, except those employed in the pumping stations of the metropolitan water and sewerage board and at the bath-houses under the control of the metropolitan park commission, shall be given a half holiday each week during the months of June, July, August and September, without loss of pay, and, if practicable, the half holiday shall be on Saturday. If, however, the public service so requires, the metropolitan park commission and the metropolitan water and sewerage board may at any time during the year give to the laborers and mechanics in their permanent service, in lieu of the said half holidays, days off duty without loss of pay equivalent in time to the half holidays which would otherwise be given under this act.

SECTION 2. This act shall take effect upon its passage.

(The foregoing was laid before the Governor on the seventeenth day of April, 1912, and after five days it had "the force of a law", as prescribed by the Constitution, as it was not returned by him with his objections thereto within that time.)

CHAPTER 656.

AN ACT TO AUTHORIZE THE TOWN OF FRAMINGHAM TO ENLARGE AND IMPROVE ITS SYSTEM OF WATER SUPPLY.

Be it enacted, etc., as follows:

The town of Framingham may enlarge, etc., its system of water supply.

SECTION 1. The town of Framingham, acting by its water commissioners, may enlarge and improve its system of water supply, and for that purpose may erect a pumping station and other necessary structures, lay pipes, aqueducts, conduits and other water courses, and may construct driven, artesian and other wells upon land in said town to be acquired therefor; and also may take, or acquire by purchase or otherwise, and hold any land, rights of way, and easements necessary for the purposes aforesaid, or for preserving the purity of the water. The town may also connect said system, as enlarged and improved, with the waters of reservoir number three of the metropolitan water works, the waters of Sudbury river or Farm pond and the waters which flow into and from said river and pond, or any reservoir constructed on said river, pond or waters situated in said town, and for the purpose of such connection may lay, construct and maintain pipes, aqueducts, conduits, driven, artesian or other wells, and other water courses in, upon and through land of the commonwealth to and into said reservoir number three or river, pond or waters or reservoirs, as aforesaid, and may distribute therefrom throughout said town sufficient water for the use of the town and its inhabitants for the extinguishment of fires and for domestic and other purposes. The point of connection with, and entrance into, said reservoir or river, pond and waters or reservoirs as aforesaid, and the location of any pipes, aqueducts, conduits, wells, or other water courses laid or constructed on land of the commonwealth, shall be determined by agreement between the town and the metropolitan water and sewerage board.

May take lands, rights of way, etc.

SECTION 2. For the purposes aforesaid the town is authorized to take, or to acquire by purchase or otherwise, any necessary land, rights of way, or other easements, to lay, construct and maintain any necessary pipes, aqueducts, conduits, reservoirs and other structures for holding, conveying, and distributing the water, or for preserving the purity thereof. The town may construct and lay pipes, aqueducts, conduits, artesian or other wells and any other water works under and over any land, including land of the commonwealth, as hereinbefore provided, water courses, railroads, railways or other public or private ways, in such manner as not unnecessarily to obstruct the same, and may do any other thing necessary or proper in executing the purposes of this act; but the town shall not enter upon, construct or lay any conduits, pipes or other works within the location of any railroad corporation except at such times and in such manner as it may agree upon with such corporation, or, in case of failure so to agree, as may be approved by the board of railroad commissioners.

Taking to be recorded.

SECTION 3. The town shall, within sixty days after the taking of any lands, rights of way, water rights, water sources or easements as aforesaid, file and cause to be recorded in the registry of deeds for the county and district within which the same are situated a description thereof sufficiently accurate for identification, with a statement of the purpose for which the same were taken, signed by the water commissioners of the town.

Payment of damages, etc.

SECTION 4. The town shall pay all damages sustained by any person or corporation by the taking of any land, rights of way, water, water sources, water rights or easements or by any other thing taken or done by authority of this act. Any person or corporation sustaining such damages and failing to agree with the town as to the amount thereof may have the damages determined in the manner provided by law in the case of land taken for the laying out of highways, on application at any time within a period of two years after the taking of such land or other property or the doing of other injury under the authority of this act. For all damages caused to the commonwealth or the metropolitan water and sewerage board by the taking of water from said reservoir, or river, pond, and waters or reservoirs as aforesaid by the town under the provisions of this act, the town shall pay to the commonwealth such sum, rate, damages, or compensation as may be agreed upon by the town through its water commissioners and the metropolitan water and sewerage board, and for all damages caused to the commonwealth or the metropolitan water and sewerage board by the exercise by the town of the rights and privileges herein granted to the town in lands of the commonwealth, the town shall also pay such sum as may be agreed upon as aforesaid, but in case the town and said board are unable to agree upon the amount of such sum, rate, damage or compensation, the matter shall be submitted to three commissioners to be appointed by the supreme judicial court upon application of either party and notice to the other, whose decision and award when accepted by the court shall be binding upon both parties.

. . . .

Existing rights not affected.

SECTION 7. Nothing in this act shall be construed to affect any existing right, power or privilege of said town to take water from any lake, stream, well, pond, brook, reservoir or other source of water supply, or to abridge any rights, powers or privileges heretofore reserved or granted to the town in respect to its water supply; and the rights, powers and privileges granted to the town by this act shall be held to be in addition to all rights, powers and privileges heretofore granted or reserved to the town.

Time of taking effect.

SECTION 8. This act shall take effect upon its acceptance by a majority of the voters of the town present and voting thereon at a meeting duly called for the purpose. [*Approved May 27, 1912.*

CHAPTER 689.

AN ACT TO PROVIDE FOR DETERMINING THE DAMAGES TO BE PAID TO THE TOWN OF STONEHAM BY REASON OF THE TAKING OF SPOT POND FOR THE METROPOLITAN WATER WORKS.

Be it enacted, etc., as follows:

Determining damages to Stoneham by reason of the taking of Spot pond, etc.

SECTION 1. Within one year after the passage of this act the town of Stoneham may file in the clerk's office of the superior court for the county of Middlesex a petition for the determination of the damages sustained by it by reason of any taking or act of the metropolitan water board or of the metropolitan water and sewerage board under authority of chapter four hundred and eighty-eight of the acts of the year eighteen hundred and ninety-five, and acts in amendment thereof and in addition thereto, and thereupon, after such notice as said court shall order, the court shall appoint a commission of three disinterested persons. The commission shall, after notice and hearing, determine the damages specified in the petition which the town sustained as aforesaid and could have recovered upon a petition filed in accordance with the provisions of section thirteen of said chapter four hundred and eighty-eight, and shall report its determination to the court. The determination, when accepted by the court, shall be final and conclusive, and the town shall thereupon be precluded from bringing any further action to recover for any damages caused as aforesaid. The court may allow the members of said commission reasonable compensation for their services, and the compensation so allowed and the damages, if any, determined as aforesaid shall be paid from the treasury of the commonwealth, and thereafter shall be apportioned and paid in the same manner in which the other expenses of the metropolitan water and sewerage board are apportioned and paid.

SECTION 2. This act shall take effect upon its passage. [*Approved May 29, 1912.*

CHAPTER 694.

AN ACT RELATIVE TO THE TAKING OF PROPERTY OF THE CITY OF BOSTON BY THE METROPOLITAN WATER AND SEWERAGE BOARD.

Be it enacted, etc., as follows:

Metropolitan water and sewerage board may take Fisher Hill reservoir, etc.

SECTION 1. The metropolitan water and sewerage board may take, or acquire by purchase or otherwise, the Fisher Hill reservoir, so called, and the land surrounding the same and the main water supply pipes belonging to the city of Boston located in the town of Brookline and the city of Somerville, and in Beacon street, Chestnut Hill avenue and land in the Brighton district of the city of Boston.

Metropolitan Water Loan.

SECTION 2. To meet the expenditures incurred under the provisions of this act the treasurer and receiver general shall, from time to time, issue, upon the request of said board, bonds in the name and behalf of the commonwealth, to be designated on the face thereof, Metropolitan Water Loan, to an amount not exceeding six hundred thousand dollars, in addition to the sum of forty-two million and ninety thousand dollars authorized to be issued by chapter four hundred and eighty-eight of the acts of the year eighteen hundred and ninety-five and acts in amendment thereof and in addition thereto, and the provisions of said chapter four hundred and eighty-eight and of acts in amendment thereof and in addition thereto shall apply to this additional loan.

SECTION 3. This act shall take effect upon its passage. [*Approved May 29, 1912.*

CHAPTER 719.

AN ACT TO ESTABLISH A COMMISSION ON ECONOMY AND EFFICIENCY FOR THE COMMONWEALTH.

Be it enacted, etc., as follows:

Commission on economy and efficiency established.

SECTION 1. The governor, with the advice and consent of the council, shall appoint a commission on economy and efficiency for the commonwealth, to consist of three persons, qualified voters of the commonwealth, one of whom shall be the auditor of the commonwealth. The chairman shall be designated by the governor, shall be appointed for the term of two years from January first, nineteen hundred and twelve, and shall receive a salary at the rate of five thousand dollars per annum. The chairman shall give his whole time to the work of the commission. The other member shall be appointed for a term of one year from January first, nineteen hundred and twelve, and shall receive a salary at the rate of thirty-five hundred dollars per annum. Annually thereafter the governor, with the advice and consent of the council, shall appoint one member to serve for two years. Any vacancy shall be filled by the governor, with the advice and consent of the council, for the unexpired term, and at the expiration or other determination of the term of the person designated as chairman the governor shall designate a person to serve as chairman. In all cases a member shall continue to serve until his successor is appointed and qualified. The members of said commission may be removed by the governor, with the advice and consent of the council.

Secretary, etc.

SECTION 2. Said commission may employ a secretary and such experts, clerks and other assistants, and may pay them such salaries, and may incur such other expenses as it may deem necessary and proper, not exceeding the sum of ten thousand dollars in the year nineteen hundred and twelve, and not exceeding thereafter such sum as may be appropriated for that purpose by the general court. All appointments under this section shall be in accordance with the rules of the civil service commission.

Estimates to be submitted to the auditor of the commonwealth, etc.

SECTION 3. Every officer or board having charge of any department, institution or undertaking which receives an annual appropriation of money from the treasury of the commonwealth, including annual appropriations to be met by assessments, shall, annually, on or before the fifteenth day of November, submit to the auditor of the commonwealth, statements showing in detail the amounts appropriated for the current fiscal year, estimates of the amounts required for the ensuing fiscal year, with an explanation of the reason for any increased appropriation, and with citations of the statutes relating thereto, and the expenditures for the current year and for each of the two years next preceding. The said estimates shall not include any estimates for special purposes or objects. The auditor, on or before the fifteenth day of December in each year, shall submit to the governor elect and to the commission on economy and efficiency copies of the amounts so required by such departments, institutions or undertakings, together with a statement of the general appropriations for said departments, institutions or undertakings of the preceding fiscal year and the expenditures for the same and the unexpended balance as of the preceding thirtieth of November. The auditor shall further embody the statements received from those in charge of such departments, institutions or undertakings, together with his estimates for the ensuing fiscal year for the ordinary and other revenue of the commonwealth, in one document, and shall have the document printed and shall transmit the same to the general court for its action on or before the first Thursday of January of each year. Copies of this document shall be distributed to the members of the general court.

Estimates for appropriations for special purposes to be submitted to the auditor, etc.

SECTION 4. Officers, heads of departments, boards, commissions and trustees of institutions, who, in their annual reports, or otherwise, recommend appropriations from the state treasury for special purposes or objects, including appropriations to be met by assessments, in addition to the ordinary running expenses, shall submit estimates thereof in detail to the auditor of the commonwealth on or before the fifteenth day of November in each year, and he shall classify and submit them to the governor elect and to the commission on economy and efficiency for their examination on or before the fifteenth day of December next succeeding, and shall have them printed in a public document, and shall transmit the same to the general court on or before the first Thursday of January of each year for its action.

Examination of estimates, report, etc.

SECTION 5. The commission on economy and efficiency shall examine the statements submitted to it by the auditor, showing the general and special appropriations asked for by those in charge of the various departments, institutions, boards and undertakings mentioned in sections three and four, and shall report thereon to the general court annually on or before the first Thursday in January, and at such other times as it may see fit, together with such facts, suggestions or recommendations as to any or all of the appropriations requested or the method of raising money for the same as it may deem expedient.

Special examinations to be made, etc.

SECTION 6. On request of either branch of the general court or of the ways and means committee of either branch, or of the governor, or of the committee on finance of the governor's council, the commission shall make a special examination of any matter affecting the management or finances of any department, institution, board, undertaking or commission mentioned in section three, and on request shall give any information in its possession to either branch of the general court or to the ways and means committee of either branch or to the governor.

SECTION 7. The commission may make a special examination of the management or finances of any of the departments, institutions, boards, undertakings, or commissions mentioned in section three and may report thereon from time to time to the governor and council and to the general court, if it is in session.

Inquiry to be made into the laws governing financial transactions, etc.

SECTION 8. It shall be the duty of the commission to inquire into the laws governing the financial transactions of the commonwealth and to study into the possibility of promoting greater economy and efficiency and utility in the transaction of the business of the commonwealth by any changes in such laws, by the reorganization, consolidation or co-ordination of departments and institutions, by different methods of administration, by classification of employees, by fixing maximum and minimum salaries, by standardizing vacations, by organizing a central purchasing agency or department, by the substitution of the budget method of appropriating money or by any other means, and it shall report thereon from time to time to the governor and council and to the general court, if it is in session.

Powers of the commission, etc.

SECTION 9. For the purpose of this act and in order to provide information which shall serve as a basis for legislation, the commission shall have the power to require the attendance and testimony of witnesses and the production of all books, papers, contracts and documents relating to any matter within the scope of any investigation authorized by this act. Witnesses shall be summoned in the same manner and shall be paid the same fees as witnesses before the superior court. The chairman of the commission or any member thereof may administer oaths to, or take the affirmation of, witnesses and may prescribe rules and regulations for the conduct of hearings and the giving of testimony. If any person so summoned and paid shall refuse to attend, or to be sworn or to affirm, or to answer any question, or to produce any book, contract, document or paper pertinent to the matter of inquiry in consideration before the commission, a justice of the supreme judicial court or of the superior court, in his discretion, upon application by the commission or any member thereof authorized thereto by vote of the commission, may issue an order requiring such person to appear before the commission, and to produce his books, contracts, documents and papers and to give evidence touching the matter in question, and failure to obey such order of the court may be punished by such court as a contempt thereof. Any person summoned and paid who shall refuse to attend, or to be sworn or to affirm, or to answer any question, or to produce any book, contract, document or paper pertinent to the matter in consideration by the commission, and any person who wilfully interrupts or disturbs any hearing of the commission, or who is disorderly thereat, shall be punished by a fine not exceeding fifty dollars, or by imprisonment for not more than thirty days, or by both such fine and imprisonment. Any person who wilfully swears or affirms falsely before the commission upon any point material to the matter of inquiry shall be guilty of perjury, and shall be subject to the provisions of sections one to five, both inclusive, of chapter two hundred and ten of the Revised Laws and amendments thereof. Upon application by the commission to any justice of the supreme judicial court, or of the superior court, the justice may issue a commission to one or more competent persons in another state for the examination of a person without this commonwealth relative to any matter within the scope of any investigation authorized by this act. The testimony of such person may be taken by open commission or otherwise under the procedure, so far as the same may be applicable, provided for by section forty-three of chapter one hundred and seventy-five of the Revised Laws, and the said justice may issue letters rogatory in support of said commission. Nothing in this act shall be construed to compel any person to give any testimony or to produce any evidence, documentary or otherwise, which may tend to incriminate him.

Commission to report to governor, etc.

SECTION 10. The commission shall make a report to the governor and council and to the general court in January of each year, showing the work done by it during the preceding year, together with such facts, suggestions or recommendations as to the finances or management of any or all of the departments, institutions, boards, undertakings or commissions of the commonwealth, as it may see fit, and shall report on or before the first Thursday in January, nineteen hundred and thirteen, what changes if any in the laws it deems advisable in relation to its existence, organization, powers or duties. Any suggestions for legislation shall be accompanied with drafts of the bills recommended.

Repeal.

SECTION 11. Chapter two hundred and twenty of the acts of the year nineteen hundred and ten and all acts and parts of acts inconsistent herewith are hereby repealed.

SECTION 12. This act shall take effect upon its passage. [*Approved June 6, 1912.*

CHAPTER 10.

RESOLVE TO PROVIDE FOR AN INVESTIGATION OF THE CONDITION OF SPOT POND BROOK IN STONEHAM, MELROSE AND MALDEN.

Commission to investigate condition of Spot Pond brook.

Resolved, That the governor, with the advice and consent of the council, shall appoint one person and the mayor of the city of Malden, the mayor of the city of Melrose and the selectmen of the town of Stoneham shall each appoint one person, and the four persons so appointed shall constitute a commission to be known as the Spot Pond Brook Commission. Said commission shall investigate the condition of Spot Pond brook in Stoneham, Melrose and Malden and report to the general court before the tenth day of January, nineteen hundred and thirteen, a plan for such improvements in said brook, by means of a retaining basin or otherwise, as will prevent flooding along the course of said brook, during the times of freshet, by the water turned into it by the metropolitan water and sewerage board from Doleful pond and the surrounding country. The metropolitan water and sewerage board shall assist the said commission by furnishing data in its possession relative to the said brook and also such reasonable engineering assistance as the commission may require. The commissioners shall be appointed within thirty days after the passage of this resolve and shall serve without pay. [*Approved February 9, 1912.*

N.

	Chap.	Sect.
NORTH METROPOLITAN SEWERAGE SYSTEM.		
to provide for new sewer in Mystic valley and for new screening machinery at East Boston pumping station in, ...	461	1
appropriation for maintenance of, ...	132	1

S.

	Chap.	Sect.
SATURDAY HALF HOLIDAY.		
to provide for, for certain employés, ...	528	1
SOUTH METROPOLITAN SEWERAGE SYSTEM.		
appropriation for maintenance of, ...	146	1
SPOT POND BROOK.		
appointment of commissioners authorized, to investigate condition of, in Stoneham, Melrose and Malden, ... Res.	10	
STONEHAM.		
to provide for determining damages to be paid to, by reason of taking of Spot Pond for Metropolitan Water Works, ...	689	1